Navigation

IN COASTING

OR THE

Sea-Mans Instructer.

CONTAINING

Severall *Theoretisall* and *Practicall*
Parts of that ART;
AS ALSO,
Some necessary Points of the Duty
of a *Carefull Sea-man*; Most
Pleasant and Profitable for all
Young-Beginners, for
Whom it is Designed.

By IOHN MARR, *Mariner in MONTROSE*

Insignia Urbis T-A O D U N I

Unto the Right Honorable

ALEXANDER DUNCAN
Lord Provest.

IOHN SCRIMGER,
IAMES FLESHER,
IAMES MAN,   } Bailies.
IOHN DUNCAN,

THOMAS MOODIE *Dean of Gild*,
ALEXANDER ARBUTHNET *Treasurer*.

And to the Rest *of the* Honorable Counsell
of the City *of* DUNDEE.

RIGHT HONORABLE.

I have made bold
to present Your HONORS *with the* Patronage

of this *small* Treatise, *being a plain Discourse upon that excellent* Art of NAVIGATION, *which is ranked amongst the chiefest of all those Arts that are most profitable for the* Common-Wealth; *Yea, without which Noble Art,* TRADE *would languish and decay. Indeed, there be very few Kingdomes, (much less this our own* Ancient-KINGDOM) *that can boast of Self-sufficiency in all Necessaries for the Maintainance of their* Inhabitants; *for, if they abound in one Thing, they are still deficient into another:* Trade *and* Commerce *with other Nations must therefore be maintained, which cannot well be done, without this* Excellent Art of NAVIGATION. *Hence it is, that in the most flowrishing Kingdomes of the World, (especially in our Neighbouring-Nation) This Noble* ART, *is amongst all others, first noticed and incuraged.*

The Pleasure and Profitableness of this Rare Art, *hath invited very many to Its Study, and my Self amongst the rest; having indeed plyed the same from my Youth: What Progress I have made therein, shall leave the same for others to judge; however, I alwayes esteem'd it my Duty, to Communicat any Knowledge, I had acquyred (by the Blessing of the Almighty) in this Noble* Art, *for the Benefit of my Loving* Countrey-Men, *as in this small Treatise will be known: Having seriously considered, that we were not born to live onely to our selves, but also to procure the Good of each other.*

There

There are Two Grand Reasons, which moved Me to Present Your Hs. with the Patronage of this small Treatise, First, seeing Divine Providence hath so Ordered You to bear the Office of Magistracy in this Loyall-CITY, under whose happy Conduct, (by the Blessing of the Almighty) we owe much of our Peace. And Lastly, knowing that there are not a few amongst your Honorable Wisdomes, who have attained to Great Skill in this Noble Art: so that You are most Capable to Patronise, and shelter this small-Treatise from Envy and blinde Ignorance.

It is indeed a Mean-Offering to present unto Your Honors, but since it is Offered (in all Humility) with the Greatest Affection of Your Servant and Citizen, Who relyeth upon Your Favour, Expecting Your Hs. will not Reject the Meanness of the Offering, because of the Weakness of the Offerer: For the Great MAGISTRATE of Heaven and Earth doth Regnard Mean-Things, when Offered with a willing Mynd.

Accept Therefore, (RIGHT HONORABLE) this Testimony of my Humble Affection in Good Part, Who shall still Pray the Almighty GOD far to Bless Your Honorable Wisdomes, and this Loyall CITY, with all Grace, Peace, and Eternall Falicity; Remaining Ever,

YOUR HONORS

Most Humble and Obedient Servant

IOHN MARE

To all Lovers of NAVIGATION.

Courteous Reader.

YOU *may be surprised with wonder, that I should appear in Print, especially on this subject, which hath been handled accuratly by the most Learned in this rare* Art of NAVIGATION. *To thrust out this Treatise now may seem also needless, as to light a penny-Candle when the Sun shineth: but I have three things to say for my self;* First, *that I cannot in Reason be condemned, except these also be condemned who have written before me, even since the first Inventers of this Noble* ART; *who have but added to the Treatises which were then in the World: and though many have already written on this Excellent* Art, *to their never dying Fame, yet they have done the same in great Volums which wold as to their bulk, terrify Young Beginners in Navigation. I designed only a Compend for the Instruction of those that are unskilfull, wherein I have laboured in also great clearness and perspicuity as could, to set down every thing that is necessary for* NAVIGATION IN COASTING *Together with some certain Points of a* CAREFULL SEA-MAN. *If it be profitable for that end, I have my design; and finally, if you will search you may find some things handled even in this small*

Treatise

Treatise, *which you will not readily meet with in greater Volumns I hope ye will not think the less of this small Treatise (as some may be ready to do) because I am your* Counttey-Man *, for if you will seriously consider, we were never inferiour to any* Nation, *in any thing. save in the* Mathematicks *: and yet not altogether in that, for, who amongst all the Mathematicians in* Europe, *hath yet parallelled our* MER-CHISTON, *see* Vincent Wing, *in his* Harmonicon Cœleste, *the beginning of his first book* chap. 5. *And* Richard Norwood *in his* Trigonometrie, *his preface to the Reader,* 2. Book, *and* 2. Chapter; *yea, and many others , &c. I hope, seeing it is a Testimony of my good will shown to you, who love this Rare* ART, *you will accept of it in good part, and wish well to the* Author,

Who is your Servaht,
Iohn Marr.

From my House at DUNDEE,
the sixth of *April,* 1683.

The Thirty-two Points of the Mariners Compass.

North,			South,
N. by E.			S. by W.
N. N. E.			S. S. W.
N. E. by N.			S. W. by S.
N. E.			S. W.
N. E. by E.			S. W. by W.
E. N. E.	Their		W. S. W.
E. by N.	Oppofite		W. by S.
Eaft.	Points.		Weft.
E. by S.			W. by N.
E. S. E.			W N W.
S. E. by E.			N W. by W.
S. E.			N. W.
S. E. by S.			N. W by N.
S. S. E.			N. N. W.
S. by E.			N. by W.

CHAP.

CHAP.

Of the Mariners Compass.

THe *Mariners Compass*, is one of the
finest Inventions in *Navigation*,
and may be justly ranked amongst
the greatest Wonders that this
World affords : and deserves well to be un-
derstood by all that are Students and Practi-
tioners in that *Art* : for by it *Roadwayes* are
traced out in the *Ocean*, from *Land to Land*,
and by this, the *Glorious Gospel* hath been con-
veyed to the most places of the World: also,
Trade and Traffique hath been procured to
the remote corners of the Earth.

As for finding out the *Load-stone*, and the
vertues of it, many have lately handled it,
therefore I forbear, informy only design here
to treat a little of those things that are most
usefull in *Navigation*, as to *Coasting*, and to
make them as plain, and easie as I can, that
they may be understood by the meanest Ca-
pacities.

First, the *Compass* was divided into parts,
commonly

B

commonly called, the 4 *Cardinall Points*, to witt, NORTH, SOUTH, EAST, WEST: now the other 28 *Points*, have all their Denomination or Names from the foresaid 4th *Cardinall Points*. There is always 7 points in every quarter, which have their Names from the two *Cardinall Points* that make their quarter, for Example, all the 7 points betwixt *North* and *East* borrows their name from *North* and *East*, and that according to their Reasons or places, so the like with the other 3 quarters.

Likewise, there are 8 points of the compass really opposite to the other 8, which they are opposite in their Places, so are they opposite in their Names, as *North North-East* to *South South-West*, and *East North-East* to *West South-West*, and the like with all the rest of it, many lately have little skill...

Now as for the dividing, and subdividing of the *compass*, I shall here treat of one quarter onely, and the *Ingenious Reader* may understand the other 3 quarters, they having the same rule for dividing, and subdividing of them, as also, their names according to their places.

First, betwixt the points *North* and *East*, is the point *North-East*, as this point divideth that quarter right in two, so it borroweth the names of both for its name: so consequently, betwixt *North* and *North-East* is the point *North-North-East*, now as this point divideth that eight part right in two, so it borroweth the names of both for its name, and so doth its opposit point *South-South West* as it divideth that eight part, (to wit) *South* and *South-West* right in two, so it borroweth the names of both for its name: Likewise the point *East-North-East* stands right in the middle betwixt *East* and *North-East*: and so it borrowes the names of both for its name, so consequently its opposite point *West-South-West* stands right in the midst betwixt *West* and *South-West*, and so borroweth the names of both for its name.

Thus the *Compass* being in 16 parts, each part being again divided in two, brings the *Compass* in 32 parts: Now for the denominations of the last 16 points of the *Compass*, know, that the 4 *Cardinal*, and 4 *Collaterall*, comonly called the 8 great points of the *Compass*, (spoken to before) have two of

the

the laſt 16 points to guard (as it were) each
one of them, which I ſhall ſhow by three
Examples, which to the Ingenious will be
ſufficient for all.

North hath one upon each ſide of it, that up-
on the *Weſt ſide* is called *North by Weſt*, and
that upon the *Eaſt ſide* is called *North by Eaſt*,
both borrowing their names from *North*,
ſo it is with their oppoſite points, *South by
Eaſt*, and *South by Weſt*, both borrowing their
names from *South*: Likewiſe, *North Eaſt* hath
one upon each ſide of it, that upon the *North
ſide* is named *North Eaſt by North*, and that up-
on the *Eaſt ſide* is named *North Eaſt by Eaſt*,
both borrowing their names from *North
Eaſt*; ſo their oppoſite points *South Weſt by
South*, and *South-Weſt by Weſt*, both bor-
rowing their names from *South Weſt*: Like-
wiſe, *Eaſt* hath one upon each ſide therof, that
upon the *North ſide* is named *Eaſt by North*,
and that upon the *South ſide*, *Eaſt by South*,
both borrowing their names from *Eaſt*,
their oppoſite points *Weſt by South*, and
Weſt by North, both borrowing their names
from *Weſt*, and the like of the reſt,

The *Compaſs* is *Geometrically* divided th

The Circle being divided in 4 parts, each fourth part being again divided in two, brings the Compass in eight parts; each 8 part being again divided in two, brings the Compass in 16 parts; and lastly, each sixteenth part being again divided in two, brings the Compass in 32 parts. Now if you divide (as aforesaid) any half of the Compass in 16 parts, lay a ruler from them by the Center and that will divide the other half in the same parts.

CHAP. II.

Of finding the hour of the Day by the Sun.

THe next thing to be learned, is that which we commonly call to bring 32 to 24, that is, the 32 points of the Compass to 24 hours, each point of the Compass being ¾ of an hour, (as to tyme) now 32 times ¾ is 24 whole, argue then, 16 points is 12 hours, and 8 points is 6 hours, and 4 points 3 hours and 2 points one hour and a half; now the Sun being at our Meridian, (as in North Latitude) at North maketh midnight, and at South maketh mid-day; So that as the Sun is distant from the said North or South part of

the *Meridian*, is Calculated (or rather
guessed) the hour of the day,

It is vulgarly said, that if a *North Sun*
make midnight, then *North-East* must make
3 in the morning, and *East* 6, and *South-East*
9, and so forth : So that every 4 points of
the *Compass* is 3 hours of tyme, so conse-
quently a *North-North-East Sun* is one hour
and a half in the morning, and *East North-
East* 4 hours and a half, and *East-South-East*
7 and a half, and *South South-East*, 10 and
a half ; so that each 2 points is one and
half hour as a foresaid, so likewise, a
North by East Sun makes 3 quarters in the
morning, and *North East* by *North* 2 hours
1 quarter, *North-East* by *East* 3 hours 3
quarters, *East* by *North* 5 hours 1 quarter,
and *East* by *South* 6 hours 3 quarters, and
so of the rest to *South*.

And what ever hour any of these make
in the morning, their opposite points make
the same in the afternoon: *Example*, a *North-
East Sun* makes 3 hours in the morning, and
its opposite point being *South-West* makes 3
in the afternoon, and *East* 6 in the morning,
and *West* 6 at night, and *South-East* 9 in the
morning

morning, and *North West 9* at night, and so of the rest.

Although this rule for finding the hour of the day by pyling the *Sun* with the *Compass*, be received by many for a truth, yet these acquainted in the *Sphears* and *Dyalling*, knowes it to be far from the truth, except in places near the *Poles* : the *Equinoctiall* being in the *Horizon*, for there the *Sun* moves parallel to the pointing of the *Compass*; For all knows that the daily motion of the *Sun* is parallel to the *Equinoctiall*; how can it be then, that the *Compass* which pointeth out any object as it moveth *Horizontally* (each points motion, quarters of an hour) should have the same rule for Calculation, when the said object cuteth the *Horizon* at *Oblique Angles*, as both *Sun*, *Moon* and *Stars* do by an Angle equal to the *Complement* the *Latitude*; There are but two ways by Instruments that the *Mariner* at Sea by the *Celestiall Bodies* knows the hour of the day or night; one way by the *Altitude*, and the other by the *Azimuth*; now those near the *Poles*, knowes best the hour of the day or night by the *Azimuth*, and can make but little use of

the

the *Altitude* to that effect: so those near the *mo*
Equinoctial, knowes best the hour of the day
or night by the *Sun* or *Stars* hight, and can
make but little or no use of the *Azimuth Li*
The *Azimuth* of the *Sun* (or of any *che*
other object) is the *Arch* of the *Horizon*
interceptred between the *Meridian* and the *Ch*
Verticall Line, passing through the *Sun* or a *thing*
any other object, and it is found out by the *and*
bearing of them by the *Compass*; and the *Al* *hea*
altitude or *hight* of any thing, is an *Arch* of the *Equ*
altitudes contained betwixt the said object *wi*
and the *Horizon*, which *Arch* is common *wi*
ly found at Sea by severall Instruments of *the*
which for that end, as *Fore-Staffes*, *Iacobs*
Staffes, *Quadrants*, and others
as at the *Poles*, every point of their *in*
Compass as to the motion of the *Sun* is *m*
quarters of an hour, so the *Sun* each 3 quarter
ters of an hour moveth *Horizontally* 11 degrees
&c. which is a point of the *Compass* *ne*
go length; but at the *Equinoctiall* the *Sun* *se*
motion in *Altitude* towards the *Zenith*, is
most alike to his motion *Horizontally* at *the*
Poles: now seeing his motion *Horizontally* *th*
at the *Poles* is 15 degrees each hour, and his *pr*
                                        motion

the motion at the *Equinoctial* being by the *Lines Almeconterath* (or mounting ways) near the same, yea directly 15 *degrees* where the *Latitude* and *Declination* are alike: so that the rule of either cannot hold. I shall not stay here to prove this, for he that's but a Chyld in *Art* knowes it, notwithstanding over all the *North Seas*, in *March* and *September*, this common rule will hold near, because the *Sun* is then near the *Equinoctiall*: as also, the most part of our *Winter*, because the *Sun* ryseth and setteth within 3 or 4 hours of the *Meridian*, but in the moneths of *April*, *May*, *Iune*, *Iuly*, *August*, this rule differeth sometymes half an hour, 3 quarters, and a whole hour, as in the midst of *Iune*, the *Sun* being *East* makes 7 in the morning, and a *West Sun* 5 at night; which is one hour of difference from the foresaid rule; the rest of the moneths not so much, as they are nearer to *September* or *March*.

Also the *Moon* being in those signs (where the *Sun* was the moneths foresaid) hath the same effect, and any who pleaseth may prove this at *Sea* and *Shore* both, at the

C   *Sun*

Sun about the midst of *June* being pyled due *East*, within 10 glass tyme shall come to the *Meridian*, and the full *Moons* in *December* the same; for the *Moon* then falleth to be in *Northern Signs*. Also, if upon any exact *Dyall*, you pyle the *Sun* due *East* (at the tyme foresaid) and then look to the shadow amongst the hour lines, you shall find it about 7 hours in the morning, and the same with the *Full-Moons* in *December* in long evening.

How needfull is the knowledge of this to all, because of our many dry *Harbours* and barred *Rivers* in our *British Coast*? for as it becometh any Master who hath a *Ship* of any great draught and is mynded to any dry *Harbour* or barred *River* to take the highest water with him, notwithstanding when he expects the highest water, he may possibly find it a foot or two fallen; for whosoever mistaketh the tyme, mistaketh also the tyde: *For Example*, there is a *Ship* intends to a dry *Harbour*, now it is known to the Master that at high water, there is but little more water then the *Ship* drawes, so that he is necessitate to attend *Full Sea*; now

b

...y any calculation he finds it will be *Full Sea* at
...some hours in the morning, and therefore in-
...tends not to approach the *Harbour* till he find
...the *Sun* at *East*, expecting it then 6 hours,
...and so then attempts the *Harbour*; now if
...it be in the moneths of *May*, *Iune* or *Iuly*,
...he shall assuredly meet with a foot or two
...fallen water; for it is latter in the day by an
...hour then was expected; for as I proved be-
...fore, that an *East Sun* about these tymes
...maketh about 7 acloak; now what great a-
...mazement will any Master be in, when he
...finds no water, let Country-men Iudge,
...for as they can make no use of their beasts
...wanting lyfe, no more can we with our
...*Ships* when we have no water to Swim them,
...and to cast in my Mite as to the helping this
...inconvenience, I have made this following
...Table, whereby the hour of the day may be
...knowen (with very little errour) over all
...the *North Seas*; for every *tenth*, *twentieth*,
...and *last* days of the moneths foresaid, be-
...ing Calculated for the middle of the *North*
...*Seas*, for the *Latitude* of 56 deg. oo min.
...and may serve for all of it.

C 2   *A Table*

A Table, shewing the time the Sun is from the *Meridian*, be-
ing upon several points of the *Compass*, from the first of
April, to the 21 of *August*.

The Days of the Moneth	N. B. and N. W. by N.	N. B. by E. and N. W. by W.	N. E. and N. W.	N. E. by E. and W. by N.	E. by N. and W. by S.	E. South, and W. by S.	E. by S. and W. by S.	S. E. by E. and S. W. by W.	S. E. and S. W.	South E. by S. and South W.
Ap. 1. Aug. 21	6.57.	5.37.	4.41.	3.53.	3.	2.24.	1.44.	1.3	0.3	
10. Aug. 1.	7.15.	6.23.	5.39.	4.34.	3.	2.16.	1.40.	0.3		
20. Aug. 1.	7.	9.6.	5.30.	4.24.	3.	2.12.	3.	6.36.	0.3	
1. July 28	7.55.	7.01.	6.7.	5.02.	16.	2.	6.	36.	0.0	
12. July 12	7.3.	6.38.	6.4.	5.8.	29.	40.3	36.39	0.17. 0.3		
20. July 1	7.50.	6.56.	0.	4.	5.3	2.36.	0.36. 0.2			
10. 639.7	6.50.	5.33	5.0.	3.24.	2.11.	24.	0.55. 0.2			

Admit the *Sun* be pyled *East* about the 10 day of *April*, or the 11 day of *August*, is demanded the hour of the day.

First, look into the *Table* at the left hand for *April* the 10, and *August* the 11, and in the Common Angle under *East* and *West* is 5 hours 29 *minutes*, which showeth that the *Sun* being *East*, or *West*, will be 5 hours 29 *minuts* from the *Meridian*: so that an *East Sun* (at that time) makes 31 *minuts* past 6 in the *morning*: and a *West Sun* 29 *minuts* past 5 in the *afternoon*.

A second Example, Admit the *Sun* be pyled at *East* by *North*, the 1 or 30 of *June*, is demanded the hour of the day.

First, look into the *Table* for *June* the 1 and 30, and in the common *Angle* under *East* by *North*, and *West* by *North*, is 5 hours 55 *minuts*, which showeth, that the *Sun* being either *East* by *North*, or *West* by *North*, will be 5 hours 55 *minuts* from the *Meridian*: so that an *East* by *North Sun* at that time, is 5 *minuts* past 6 in the *morning*: and a *West* by *North Sun*, will make 55 *minuts* past 5 at *night*, and the like with an

any other. Although for brevities sake, I
have Calculated this *Table* for every first,
tenth, and twentieth dayes of the moneths
foresaid, yet it may serve for any other
day betwixt them, without any great error.

Note, That as a *South-East Sun* in Sum-
mer makes the day latter then by the Com-
mon Rule, so a *South-East Sun* in *Winter* is
a more rymous in the day then by the Com-
mon Rule; for a *South-East Sun* in *Decem-
ber*, will make about 40 *minuts* past 8 in the
morning; so that it is not so late of the day
by 20 *minuts* as the Common Rule would
make it. I leave the rest to your own
Practice.

Note, *Secondly*, that in *South Latitude* the Sun
coming to the *North Part* of the *Meridian*
maketh midday, and being at *North-East*
will make the same time of the day, that
the Sun being *South-East* doth to us, and
the Sun there being *North-West*, giveth the
same time of the day, that a *South-West*
Sun giveth with us; I mean in places dif-
ferent and from the *Equinoctiall*.

CHAP.

CHAP. III.

Of the Golden Number.

THe *Golden Number* or *Prime*, is a *Circular Revolution* of 19 Years, in which tyme it hath been Antiently supposed that the *Sun* and *Moon* do make all their variety of *Aspects* one to another; Example, in any Year, or in any day of the moneth see how old the *Moon* is, now the same day of the *Moneth*, and the same day of the *Moneth* shall not tryst to be in one day, till the same day 19 Years.

The way to find it, is by dividing the Year of our Lord by 19, and what remaineth add one to it, and that is the *Golden Number*. As for Example, In the Year 1682 I find the *Golden Number* to be 11, for having divided the Year by 19 as aforesaid, I find 88 in the Quotient and 10 remaining, which showeth that there are 88 *Golden Numbers* past their Courses since the first Year of our ever blessed Saviour, and the Remainder being 10 of a new one: Now seing that the *Golden-Number* happped to be one that Year, therefore is alwayes one added

added to the Remainder, as in this making
11 for the *Golden Number*, this number
amounteth one every Year till it be 19, and
so beginneth again. It's of use to find
the *Epact*.

CHAP. IV.
Of the Epact.

THe *Epact* is an odd number of dayes bea-
ing 11, which the *Solar Year* hath more
then the *Lunar Year*.

The *Solar Year* of 12 moneths containeth
365 dayes 6 hours, and the *Lunar* or 12
Moons containeth 354 dayes 6 hours. So that
there is 11 dayes of difference : for if the
12 *Moneths* and 12 *Moons* were alike there
would be no *Epact*.

The way to find this *Epact*, for any year
is this, find first the *Golden Number*, (as is
before taught) and having the *Golden Number*
Sc. multiply it by 11, and divide that pro-
duct by 30, and what remains is the *Epact*.
As for *Example*, In the foresaid Year 1682,
the *Golden Number* being 11, I multiply it
by 11, and the product is 121. the which
I divide by 30, and the *Quotient* is 4 : there

ng that 4 *Epacts* hath run away in *Moons*
ince this *Golden Number* did begin ; and the
emainder being 1 of a new one.

There is another way to find this *Epact*,
and it is thus, add to what was last Year
1, and if this sume surmount not 30 it is the
Epact, but if it surmount 30, what is over
30 is the *Epact* : *As for Example*, in the
Year 1682, the *Epact* is 1, and the Year
1683 being 11 more makes it to be 12, and
the Year 1684 being 11 more makes it to be
23, and so in the Year 1685 it will be 4,
for 23 and 11 is 34, and so substracting 30
there remaineth 4 for the *Epact*.

Note, Secondly, that this *Epact* every 3
Year runs away in a *Moon* and 3 days more,
That is, every 36 moneths (or 3 Year) hath
37 *Moons* and 3 dayes.

Note, That this *Epact* changeth not till
March; By the *Epact* and day of the *Moneth* is found the age of the *Moon*, as shall
be showen hereafter.

C H A P. V.
Of the L E A P-Y E A R.

THe *Leap-Year* being every 4th Year, is
caused by the odd six hours, that every
Year

D

Year hath more then 365 dayes, the S... o...
(or the *Earth* as *Copernicus* would have it)de...
passeth from some point of the *Ecliptick* ...
and in 365 dayes 6 hour (or more exact... ut...
365 dayes 5 hours 49 minuts) he return...t ...
eth to the same point again; now these od... ...
6 hours (for I speak avoyding fractions) i... ...
4 Years time, amounteth to a natural da... the...
which causeth every fourth Year or *Lea...* ...rv...
Year to have 366 dayes, and this day is a... ay...
wayes given to the moneth of *February*, f... In...
that every *Leap-Year* it hath 29 dayes.

Now whether it be *Leap-Year*, or any o... T...
the other three, is commonly found by d... i...
viding the Year of our Lord by 4, and if no...
thing remain, it is *Leap-Year*; and if on...
remain, it is the first from the *Leap Year*, a... T...
if two remain it is the second from the *Lea...*, ...
Year, and so of the third. ...em...

Which of these Years it is, is needfull t... *Let...*
be known to him who is taking the S...der...
Meridian Altitude, to know the *Latitu...*
because of the *Suns* declination.

CHAP. VI
To find the SUNDAY LETTER.

TO find the *Sunday Letter*, add to the Y...

... our Lord its 4th part and 4 , and di-
vide that sume by 7, and what remains sub-
stract from 7, and what then remains ac-
counted from A to G is the *Sunday Letter*:
but the *Leap Year* hath two Letters, the Let-
ter found by the former rule serveth from
St. *Mathias Day* to the Years End , the
other following in order from A to G,
serveth from the new Year to St. *Mathias*
his Day. *Take Example for both*

In the Year of our Lord 1682, is demaun-
ded the *Sunday Letter*.

The Year   1682
its 4th part omitting *Fractions* 420
           and   4
                 2106

This I divide by 7, and there remaineth
6, which 6 I substract from 7, and there
remaineth 1, which showeth the *Sunday*
Letter to be A, as being the first in or-
der to the *Alphabet*.

A second Example. In the Year 1684 is
demaunded the *Sunday Letter.* The for-
mer total (made up of the Year its Quarter
and 4 being 2109) I divide by 7, and there
remains 2; which 2 I substract from 7, and
there

there remains 5, now 5 reckoned according
to the order of the *Alphabet* from A, is E
which letter E serveth from *St. Mathias*
Day to the Years End, and F from the
New Years day to *St. Mathias*.

Its of use by having the day of the Moneth to find the day of the Week, and by
the knowing the day of the Week, to find
the day of the Moneth, and these may be
done by the help of the *Common Kallenders.*

It is demaunded what day of the Week
is the 7 day of *February* 1682, *First*,
find the *Sunday Letter* for that Year (which
in the common *Kallender* is called the *Dominicall Letter*) to be A, then I look in the
common Tables, where is Calculated the
Suns Place, *Declination*, and *Day* of the
Moneth, and in the common *Angle* of the
Week Dayes, with the Dayes of the Moneth, I find that the 7 day of *February* had
the Letter C: now I consider that C is the
second Letter from A, (the *Sunday Letter*)
Therefore, the 7 day of this Moneth must
be the second day from *Sunday*, Which is
Tuesday: So that the 7 day of *February*
1682, is *Tuesday*.

Question the second, Let it be demanded what day of the Moneth is the second *Sunday* of *March* 1682.

First I find that the *Sunday Letter* for that Year is A, therefore I look in the Tables for *March* Moneth, and I find the second A to be in the common *Angle* with the 12 day of the Moneth, So that the second *Sunday* of *March* 1682, is the 12 day of the Moneth, and D being for *Wednesday*, is the 15 day, and so of the rest.

CHAP. VII.

To find the day of the Moon, *having the day of the* Moneth, *in any Year, past, present, or to come.*

First find the *Epact* for that Year wherein the *Question* is propounded, and add it to the day of the Moneth, together with one for every Moneth from *March*, to the Moneth wherein the *Question* is propounded, (Including both Moneths) and if these 3 Numbers be less then 30, it is the Age of the Moon, but if these 3 Numbers exceed 30, (the Moneth having 31 dayes) what is over 30 is the Age of the *Moon*, but if the

Moneth have but 30 dayes, what is over
29 is the Age of the Moon, for the better
understanding of which, take these two
Examples.

August the 10 day 1682, is demaunded
the Moons Age.

The Epact is	1
The day of the Moneth	10
The Moneths from March	6
The Moons Age.	17

First I find the Epact for the Year fore-
said, and I find it 1, to which I add the
day of the Moneth 10, together with one
for each Moneth from March which is 6,
these three being added together as you see,
gives 17 for the Moons Age : So I conclude
that the 10 day of August 1682 the Moon is
17 dayes old, this will hold very near.

A second Example.

In the Year 1683, October the 20 day,
is demaunded the Moons Age.

The Epact is	12
The day of the Moneth	20
The Moneths from March is	8
	40
Substract	30
The Moons Age	10

First I find the *Epact* for the foresaid Year to be 12, to which I add the day of the Moneth 20, together with one for every Moneth from *March* is 8, these being added together (as you see) giveth 40, from which I subtract 30, and there remaineth 10 for the *Moons* Age, now if the Moneth had but 30 dayes I would have subtracted 29, and so of the rest.

CHAP. VIII.

To know the distance or wideness, betwixt Sun *and* Moon *any day of her Age, in points or parts of a point of* the Compass,

AS for the clearing of this, *First*, It is to be understood, that 60 *minuts* as to tyme is one *hour*, and so consequently 30 *minuts* half an hour, and 15 *minuts* a quarter of an hour; So 45 *minuts* 3 quarters of an hour, or a point of the *Compass*; 4 *minuts* of time is one *degree* in *length*, and so 60 *minuts* (or one hour of tyme) is 15 *degrees* in *length*; so that 11 *deg.* 15 *min.* in *length* is a point of the *Mariners Compass*. A *degree* in *length*, is divided

in 6o parts, called *minuts*, the same with
an hour of time.

These things being premised, I come
now to Practice, which I shall discuss, cal-
culating by time according to the antient
method thus, finding it an old Practice
and fitest for the meanest Capacity.

At the *Change of the Moon*, the Sun
and *Moon* being upon one point of the *Com-
pass*, the *Moon* every day thereafter, till
the 15 day, moveth away from the *Sun* a
point of the *Compass*, and a fifteenth part
(or a *point* and 3 *minuts*) which is 48 mi-
nuts in time. Now after the *Full Moon* the
all to the next *Change*, she cometh nearer
the *Sun* a point and 3 *minuts* each day, e-
qual to the motion she had at first from
the *Sun*. For any thing moving round in
a Circle at an equal motion, when once
it passeth the opposite point, it moveth the
towards the place it set from at first, and
the time of the motion of one *Semi Circle*
is alike to the time of the other, So
vulgarly say, that 15 dayes the *Moon* pa-
eth from the *Sun*, and 15 dayes towar
him again.

The

There are two ordinarie rules then, whereby you may easily know the distance of the *Moon* from the *Sun* by any day of her *Age*: the one serveth from the *Change* to the *Full Moon*, and the other, from the *Full Moon* to the next *Change*; which are these.

As many dayes as the *Moon* is old, so many *points* and 3 *minuts* is betwixt them, thus to the *Full Moon*, and after *Full Moon*, consider how many dayes the *Moon* hath to go to the next *Change*, and so many *points* and 3 *minuts* is betwixt them: I mean *her Points of the Compass*.

Also know, that to the *Full Moon* the *Sun* goeth foremest, and the *Moon* (as it were) following *Him*, and in the old of the *Moon*, the *Moon* goeth foremest, and the *Sun* following *Her*.

Let the *Moon* be 10 dayes old, is demaunded *Her* distance from the *Sun*: To clear this by *Examples*.

Seeing every dayes motion of the *Moon* from the *Sun* is one *point* and 3 *minuts*, *Argue*, 10 dayes motion, makes the *Moon* to be distant from the *Sun* 10 *points* 30 *minuts*.

E   Again

Again, let the *Moon* be 22 dayes old,
is demaunded *Her* diftance from the *Sun*
For this firft confider, *She* hath 8 dayes
to go to the next *Change.* fo 8 dayes mo-
tion of the *Moon* to the *Sun,* is 8 *points* 24
minuts, which is the diftance required.

By this we come to know the hour of
the night by the *Moon* any day of *Her*
Age, which I fhall hold out here in pro-
pounding of 6 *Queftions*, and anfwering
them; as 3 before the *Full-Moon*, and
after, which to the Ingenious will ferve
for all.

CHAP. IX.

To know the hour of the Night, by
the Moons *bearing of the* Compafs,
any day of her Age.

THe firft *Queftion*, Let the *Moon* be
feen at *South-Weft* 5 dayes old, is de-
maunded the hour of the *Night*.

Firft confider, that if the *Moon* be
dayes old, then there is 5 *points* 15 *minut*
betwixt *Her* and the *Sun*, and the *Moon*
being at *South-Weft*, and the *Sun* 5 *points*
35 *minuts* before *Her*, makes the *Sun*

be at *West* by *North* 15 *minuts Northerly* ; which makes 7 aclock at night : so that a *South-West Moon* 5 dayes old, makes 7 aclock at night.

The second Question, Admit the *Moon* be pyled at *West* 12 dayes old, is demaunded the hour of the *Night.*

For this, *First* consider, that there is 12 points 36 *minuts* betwixt the *Sun* and *Moon,* and the *Moon* being at *West*, and the *Sun* 12 points 36 *minuts* before *Her*; which makes the *Sun* to be at *North East* 36 *minuts Easterly,* and this makes 36 *minuts* past 3 in the *morning.*

The third Question, Suppose the *Moon* be seen at *South* 10 dayes old, is demaunded the hour of the *Night,* or as it is by some propounded thus, when cometh the *Moon* to the *Meridian* the 10 day ?

For this, *First* consider, that there is 10 points 30 *minuts* betwixt *Sun* and *Moon,* now the *Moon* being at *South* and the *Sun* 10 points 30 *minuts* before *Her*, makes the *Sun* to be at *West North-West* 30 *minuts Northerly*: which makes 8 aclock at night, the time of the *Moons* coming to the *Meridian* or *South* the 10 day. E 2

A fourth Question, Let the *Moon* b[e]
at *East* 22 dayes old, is demaunded th[e]
hour of the *Night*.

Confider here, that the *Moon* hath 8 day[ly]
to go to the next *Change*, fo *argue*, fhe i[s]
8 points 24 *minuts* from the *Sun*, and th[e Sun]
Sun (as it were) behinde *Her*: fo recko[n ha]
8 points 24 *minuts* from *East* to the le[ft]
hand, and you will find the *Sun* to be [at]
North, 24 *minuts* *Westerly*; which make[s the]
36 *minuts* paſt 11 aclock at *night*, the tim[e Me]
of the *Moons* being *East* the 22 day [by]
the *Moon*.

The fifth Question, Admit the *Moon* b[e]
feen at *South-East* 20 dayes old, is demau[n]
ded the hour of the *night* ?

Here the *Moon* hath 10 dayes to go t[o 12]
the next *Change*, fo *argue*, there is 10 *point[s]*
30 *minuts* betwixt them; reckon then 1[0]
points 30 *minuts* from *South-East* to the
left hand, and you will find the *Sun* [at]
North, North-East 30 *minuts* *Northerly* whic[h]
makes 1 aclock in the *morning*, which [is]
the time required.

The fixth Question, When comes th[e]
Moon to the *Meridian* the 20 day ?
Recko[n]

Reckon 10 *points* 30 *minutes* from *South* to the left hand, and this finds the *Sun* to be at *East-North-East* 30 *minuts Norther-ly*; which makes 4 aclock in the *morning*.

And thus, may any unlettered man find the hour of the *night* by the *Moon* having her *Age*.

There is also another way by *Arith-metick* to know the hour of the *night* by the *Moon*, which is thus, Multiply the *Moons Age* by 48, and divide that *product* by 60, and the *Quotient* gives *hours*, and the *Remainder minuts* of the time that the *Moon* shall come to the *Meridian*: if it be under 12 *hours* it is the time in the *after-noon* but if it exceed 12 *hours*, substract 12 *hours* from it, and what remains is the *hour* in the *morning*.

So by this Rule, is found the time of the *Moons* comeing to the *Meridian* or *South*, any day of *Her Age*.

If the *Moon* be to the *West-wards* of the *Meridian* or *South*, then consider *Her* time from the *South*, (every *point* of the *Com-pass* 3 *quarters* of an *hour*) and add it to the time she came to the *south*, and if that

sume exceed not 12 *hours*, it is the tim[e]
afternoon: but if it exceeds 12 *hours* sub-
stract 12 *hours* from it; and the remainder
is the time in the *morning*

But if the *Moon* be to the *East-wards* o[f]
the *Meridian* or *South*, consider *Her* time
as aforesaid, and substract it from the time
of *Her* comeing to the *South*, and the re-
mainder is the time desired (if *New Moon*)
in the *afternoon*, and if *Old Moon* it is th[e]
time after *midnight*.

But if the time from the *Meridian*, ex-
ceed the time of *Her* comeing to the *Me-*
ridian, so that substraction can not be
made; then add 12 *hours* to the time of
the *Moons* comeing to the *Meridian*, and
from that sum substract the time from the
Meridian, and the remainder (if *New Moon*)
is the time required in the *fore noon*: and
(if *Old-Moon*) the time of the *fore-night*

According to this method likewise I
shall answere these *Questions*.

Let the *Moon* be 10 dayes old, is de-
maunded the hour or time of *Her* come-
ing to the *Meridian*? *First*, multiply
by 48 and it is 480, the which divide by 6

nd the *Quotient* gives 8, and nothing
remaining, which is 8 aclock at *night*, the
time demaunded.

The second *Question*, Let the *Moon* be
20 dayes old, is demaunded the hour or
time of *Her* comeing to the *Meridian*.

First, multiply 20 by 48, and it gives
960, the which divide by 60, and the
Quotient giveth 16, and nothing remain-
ing; from which substract 12 hours, (the
time betwixt *mid-day* and *mid-night*) and
there will remain 4, the time in the
morning requyred.

So the *Moon* being 20 dayes old, *she*
cometh to the *Meridian* or *South*, at 4
oclock in the morning: So much for find-
ing the time of the *Moons* comeing to the
Meridian.

Now it followeth how to find the hour
of the *night* or *day*, by the *Moon*, being
pyled upon any other point of the *Compass*.

The third *Question*, Admit the *Moon* be
seen at *South-West* 10 dayes old, is de-
maunded the hour of the *night*.

First, by the former Rule, find the
time of *Her* being *South*, which will be
                                        about

about 8 aclock at *night*, now feeing th
Moon is 3 hours (for fo is 4 points
paft the *Meridian* or *South*, therefore ad
it to 8 hours (the time of her being *South*
and it makes 11 at *night*, the time de
fired.

The fourth Question, Admit the *Mo*
be feen at *Weft* 12 dayes old, is demaun
ded the hour of the *night*.

Find firft the time of the *Moons* com
ing to the *South*, which will be about
minuts paft 9 at *night*, now feeing th
Moon is at *Weft*, which is (commonl
called) 6 *hours* from the *South*; fo ad
6 *hours* to 9 *hours* 36 *minuts*, and it is
hours 36 *minuts*, from which fubftract
hours, and there remaineth 3 *hours* 36 m
nuts, the time in the *morning* defired:
that a *Weft Moon* 12 dayes old, makes 3
minuts paft 3 aclock in the *morning*.

The fifth Question, Suppofe the Moon b
feen at *South-Eaft* 20 dayes old, is demaua
ded the hour of the *night*.

Firft, find the time of the *Moons* com
ing to the *South*, which will be about
aclock in the *morning*, now the *Moon* bein

than *South-East*, which is 3 *hours* from the Meridian or *South*, therefore, substract 3 from 4 and their remains 1, the time in the morning desired.

The sixth *Question*, Admit the *Moon* be seen at *East* 18 dayes old, is demaunded the hour of the *Night*.

First, find the time that the *Moon* cometh to the *Meridian*, and it will be found at 24 *minuts* past 2 in the *morning*: Now the *Moon* being at *East*, is commonly called 6 *hours* from the *Meridian*, here the time from the *Meridian*, is more then the time that she came to the *Meridian*, therefore add 12 *hours* to the time of her comming to the *Meridian*, and it is 14 *hours* 24 *minuts*, from which substract 6 *hours*, and there remaineth 8 *hours* 24 *minuts* for the time at night desired, so that an *East Moon* 18 dayes old, maketh 24 *minuts* past 8 a clock at night.

And so much for finding the hour of the night by the *Moon*, this will hold without any great Errour, except when the *Moon* is in the *Northern-Signs*, for then the calculation will be as with the *Sun*.

F For

For as I proved before, that any of the
Celestiall Bodies making an *Horizontal mo-
tion* of a *point* of the *Compass*, was not
quarters of an hour, as in our *Latitude*,
if either *Sun* or *Moon* be in or near the
Signs of *Gemini* or *Cancer*; and be either
East or *West*, though they be 8 *points* from
the *Meridian*, yet are they not 6 *hours*,
but rather 5 *hours*, as in the former *Table*.

Therefore, if you would know the time
of the night more exacter by the *Moon*,
learn to know what *Sign* she is in, and
then look into the former *Table*, what time
from the *Meridian* the *Sun* was, when he was
in the same *Signe*, and upon the same point
of the *Compass*; for the like is to be un-
derstood with the *Moon*, though not alto-
gether so, because of the *Moons Latitude*.

As for Example.

Let the *Moon* be seen at *West* 10 dayes
old, and the *Moon* at that time, being
or near the *Signs* of *Gemini* and *Cancer*,
which let be the 20 *degree* of *Gemini*, is de-
manded the hour of the night.

By the former rule, you will find that
the *Moon* cometh to the *Meridian* at 8
clo

clock at night. _Secondly_, confider the day
of the _Moneth_, when the _Sun_ was in the
20 degree of _Gemini_, (being the _Moons_
place at prefent) and you will find it to
be about the 30 day of _May_; Then enter
the _Table_ before, and you will find an _Eaft_
or _Weft Sun_, to be about 5 _hours_ from the
Meridian: fo confidering the _Moon_ to be
the fame, therefore add 5 _hours_ (the time
betwixt _Weft_ and the _Meridian_) to 8 _hours_
the time fhe came to the _Meridian_, and it
is 13 _hours_, then fubftract 12 and there re-
maineth 1 which is the time in the _mor-
ning_ defired.

CHAP. X.

To find the Sun and Moons place, at
all times.

FOr underftanding of this, you muft
obferve the dayes of the _Moneths_, on
which the _Sun_ entereth the twelve _Signs_,
which is thus.

Aries.	_Taures._	_Gemini._	_Cancer._
March.	April.	May.	Iune.
9	9	19	10

Leo

Leo.	Virgo.	Libra.	Scorpia.
July.	Augutt.	September.	October.
12	12	12	12

Sagittarius.	Capricornus.	Aquarius.	Pisces.
November.	December.	Ianuar.	Februar.
11	10	9	8

Now having the day of the moneth
that the *Sun* entereth into any of the *Signs*,
you may easily know the *degree* of the
Suns place for each day thereafter.

As for Example, The 20 day of
May is demaunded the *Suns place*.

By the former *Table*, you will find that
the *Sun* entered in *Gemini* the 10 day of
that *Moneth*, so then the 20 day is 10
dayes since, and by allowing one *degree* for
each day, maketh the *Sun* to be 10 *degree*
in *Gemini*, which is the *Suns place* required.

A second Example, The 5 day of *December*, is demaunded the *Suns place*.

By the former *Table* also, you will find that
the *Sun* will enter *Capricorn* the 10 day of the
said moneth, so *Argue* he hath 5 *degrees* to
spend of the former *Sign*, (by allowing one
degree for each day) which makes the *Sun* to
be 25 *degrees* in *Sagittarius*, (for 30 *degrees*

a, is a *Sign*) so this is the *Suns place* required for that day.

And thus, you may find the *Suns place* for any day through out the Year.

Now it followeth, to know the *degree* of the *Sign* the *Moon* is in, called the *Moons place.*

Know, that the *Moon* passeth through the 12 *Signs* in 27 *dayes* 8 *hours*, so that every dayes motion of the *Moon*, is 13 *degrees* 11 *minuts*, which motion is to be reckned according to the succession of the *Signs*: know also, that at the *Change* of the *Moon*, we commonly reckon the *Moons place* to be the same with the *Suns* at that time: Therefore if ye would find out the *Moons place* any day of her *Age*, find first the day of the *Moneth* she *Changed* last, and remark the *degree* of the *Suns place* that day, for it is the *Moons place* also.

Then from that *degree*, count 13 *degrees* 11 *minuts* for each day of the *Moons Age* thereafter, (according to the succession of the *Signs*) so have you the *Moons place.*

As for Example. The 7 day of *March* 1682, the *Moon* being then about 9 dayes

old, is demaunded the *Moons place.*

First, confider the day of the *Moon Change*, and you will find it to be the 26 day of *February*, (or thereby) for if the *Moon* be 9 dayes old the 7 day of *March*, then fhe changed the 26 of *February*; at which time, the *Sun* and *Moon* was in the 18 *degree* of *Pifces*: Now the Moon having 9 dayes motion fince, at 13 *degrees* 11 *minuts* for each day, is 118 *degrees* 39 *minuts*, which 118 *degrees* (for I omit the *minuts*) muft be accounted from the 18 *degree* of *Pifces*, (the *Moons place* at the *Change*) and the *Moon* will be found to be 16 *degrees* in *Cancer*, which is accounted thus.

Add 18 *degrees* to 118, and it is 136 *degrees*, which is accounted from the firft of *Pifces* which being divided by 30, giveth 4 *Signs* 16 *degrees*, the which being accounted from the firft of *Pifces*, maketh the *Moon* to be in the 16 *degree* of *Cancer*, which is the *Moons place* required.

And after this manner, may you find the *Moons place* at any time; you may alfo to account for every 7 dayes of the *Moon* 3 *Signs*, and for 14 dayes 6 *Signs*;

proportionally this will hold near.

For remark the *First quarter Moon* in *March*, and the *Full Moon* in *December*, and the *Last quarter Moon* in *September*, all be about the *Signs* of *Gemini* and *Cancer*; therefore, about these times, the *Moon* riseth about *North-East*, and setteth *North-West*, and shineth near 17 *hours* and a *half* from *rysing* to *setting*: So consequently, the *Last quarter Moons* in *March*, the *Full Moons* in *Iune*, and the *First quarter Moon* in *September*, is alwayes about the *Signs* of *Sagittarius* and *Capricornus*, and ryseth about these times, near *South East*, and setteth *South-West*, and shineth about 7 *hours*.

So here you see, that when the *Moon* is in *Northeren Signs*, she riseth to the *North-wards* of the *East*, and setteth to the *North-wards* of the *West*: And being in *Southern Signs*, she riseth to the *South-wards* of the *East*, and setteth to the *South-wards* of the *West*: the rysing and setting *Points*, being alwayes alike distant from the *Meridian*.

So whether *Sun*, *Moon*, or *Stars*, *North Declination*, hath *North Amplitude*: And whereas

whereas it is vulgarly said, that if the Moon
be going high, it is a token of stormie
weather, as if it were alwayes bad wea-
ther when the Moon is in *Northern Signs*
I find no reason why this is so believed
except it be thus, the greatest benefit we
have of the *Moons* light, is from the *first*
quarter to the *last*, (or from the 8 day to
the 22) and when are we more desirous
of the benefit of this light, then in the
moneths of *November, December, Ianuary*
which three moneths, the *Moon* falleth to
be in *Northern Signs* when she is best light-
ed, and commonly, in these three moneths
most of our *Winter-Gusts* falls out.

And so much for finding the place of
the *Moon*, in so far as it is necessar for *Sea-*
men to know the *hour* of the night, for un-
derstanding Her *Amplitude*, and time of
Rysing, take this following *Table*.

Here followeth a Table, showing the Moons
 Amplitude, and time of Rysing *and*
 Setting, *to every* 24th *part of the*
 Ecliptick: *for the Latitude of*
 56 deg. oo min. North.

The Moon in the six Nothern Signs.		Riseth	Seteth,	befor or after the Meridiã.
				ho. mi.
	first of *Aries* and *Libra*,	East,	West.	6.00.
The Moon being in, or near the	middle of *Aries* and *Virgo*,	E. by N.	W. by N	6.36.
	first of *Taurus* and *Vigo*,	E by N. h. N.	W. by N h. N.	7.12.
	middle of *Taurus* and *Leo*,	E. N. E. h. N.	W. N w. h. N.	7.46.
	first of *Gemini* and *Leo*,	N. E. by E. h. N.	N. W. by W. h. N.	8.12.
	midle of *Gemini* and *Cancer*,	N. E. q. E.	N. W. q. W.	8.31.
	first of *Cancer*.	N. E.	N. W.	8.39.

The Moon in the six Southern Signs.		Riseth,	Seteth,	befor or after the Meridiã.
				ho. mi.
	middle of *Libra* and *Pisces*,	East by South,	West by south,	5.24.
The Moon being in, or near the	first of *Scorpio* and *Pisces*,	E. by S. h. S.	W. by s. h. s.	4.48.
	middle of *Scorpio* & *Aquarius*,	E. S. E. h. S.	W. s. W. h. s.	4.14.
	first of *Sagittarius* and *Aquarius*	S. E. by E. h. s.	s. W. by W. h. s.	3.48.
	middle of *Sagittarius* and *Capri.*	sou. east q. E.	s. W. q. W.	3.29.
	first of *Capricornus.*	south east.	south West.	3.21.

G   By

By this foregoing *Table*, you may fin
the *Moons Amplitude*, and time of *Ryfing*
to every 24*th* part of the *Ecliptick*, which
I shall show here by two *Examples*:

For the First, Admit the *Moon* be 10
dayes old, and by calculation found to b
about the first of *Gemini* or *Leo*, is de
maunded her *Amplitude* and time of *Ryfing*
and *Setting*.

First, find the time of her coming to
the *Meridian*, as before is taught, and
you will find it 8 aclock at *Night*
Then look into the *Table*, and you will
find that when the *Moon* is in, or near the
first of *Gemini* or *Leo*, she riseth N. E. *by*
E. *h. Northerly*, and setteth N. W. *by W*
h. Northerly; and she shineth before and
after the *Meridian* 8 *hours* 12 *minuts*.

Now seeing she came to the *Meridian*
at 8 aclock at night, and did *Rise* 8 *hour*
12 *minuts* before that; and set 8 *hours* 12
minuts afterward; then *Argue*, she will
Rise at 48 *minuts* past 11 in the *forenoon*
and *Set* 12 *minuts* past 4 aclock next *mor*
ning, the time desired.

The second Example, Let the *Moon*

find 10 dayes old; and by calculation found *sing* to be in, or near the middle of *Scorpio* which or *Aquarius*, is demaunded her *Amplitude* and time of *Rising* and *Setting*.

First, find the time of her coming to the *Meridian* or *South*, and you will find it at 4 aclock in the *morning*, then look into the *Table*, and you will find that when the *Moon* is in or near the middle of *Scorpio* or *Aquarius*, She Riseth E. S. E. h. *Southerly*; and Setteth W. S. W. h. *Southerly*, and shineth before and after the *Meridian* 4 hours 14 *minuts* : Now seeing she will come to the *Meridian* at 4 aclock in the *morning*, and will *Rise* 4 hours 14 *minuts* before that, and Set at 4 hours 14 *minuts* thereafter; then *Argue*; she will *Rise* at 46 *minuts* past 11 at *night*, and Set at 14 *minuts* past 8 aclock next *morning*. And thus may you come near to the time of the *Moons Rysing* and *Seting*, and *Amplitude*, any day of *Her Age*.

G 2

CHAP. XI.

To find the hour of the Night by the shaddow of the Moon, upon a Sun-Dyall.

OBserve on a *Sun-Dyall*, what *hour-line* the shaddow of the *Moon* falls upon, and take notice; how much the shaddow doth either lack or is past the *hour* of 12 upon the *Dyall*; for so much it doth want of, or is past the time of the *Moons* comeing to the *Meridian* or *South*.

As for Example.

Let the *Moon* be 11 dayes old, and the shaddow of the *Moon* did fall on the line of *9*, is demaunded the hour of the *Night*.

First, find the time the *Moon* will be *South*, which you will find to be at 48 *minuts* past 8 aclock at night; now seeing the *Moon* wants 3 hours of the *Meridian* or *South*, (for there is 3 hours between 9 and 12) therefore it wants 3 *hours* of 8 *hours* 48 *minuts*, which is 48 *minuts* past 5 aclock in the *evening*.

For

For remark, that when the shaddow that night is on the line of 12, then is it 48 *minuts* past 8 aclock at night, so *Argue*: But if the shaddow of the *Moon* had been at 3 upon the *Dyal*, then you must add 3 *hours* to the time she came to the *South*, and it will make 48 *minuts* past 11 at night.

And *Note*, that when the *Moon* is in the *Full*, then the shaddow of the *Moon* shews the true hour of the night, as the shaddow of the *Sun* doth by day.

CHAP. XII.

To find the Hour of the Night, by Orions-Girdle, vulgarly called the Ladies-Elwand.

HAving considered that these 3 *stars* is known almost to every one, I have therefore made this following *Table*, by the help of which, the meanest Capacity may know the hour of the *Night*, more quickly and exactly then by the *Moon*.

A Table *showing the houre of the night that Orions-Girdle shall come to the Meridian, from the first of September, to the first of March, to every 1. 3. 5. 7. 9. dayes of the moneth.*

	Septē-ber.	Octo-ber.	Novē-ber.	Decē-ber.	Ianu-ary.	Febru-ary.
	ho. mi.	ho. mi.	ho. mi.	ho. mi.	ho. mi.	ho. mi.
1.	6. 00 M.	4. 8.	2. 9	0. 2. A	9. 40.	7. 33
3.	5. 52	4. 0.	2. 1	11.50.	9. 32.	7. 25
5.	5. 44	3. 53.	1. 52.	11.42.	9. 24.	7. 17
7.	5. 31	3. 45.	1. 46.	11.34.	9. 15.	7. 9.
9.	5. 27	3. 38.	1. 38.	11.25.	9. 6.	7. 1.
11.	5. 19.	3. 30.	1. 29.	11.15.	8. 58.	6. 54.
13.	5. 11.	3. 23.	1. 20.	11. 6.	8. 49.	6. 46.
15.	5. 8.	3. 15.	1. 11	10.58.	8. 41.	6. 39.
17.	5. 0.	3. 7.	1. 2.	10.48.	8. 33.	6. 31.
19.	4. 52.	3. 0.	0. 53.	10.39.	8. 25.	6. 23.
21.	4. 45.	2. 52.	0. 44.	10.30.	8. 17.	6. 16.
23.	4. 37.	2. 45.	0. 36.	10.21.	8. 8.	6. 9.
25.	4. 30.	2. 38.	0. 27.	10.12.	8. 0.	6.
27.	4. 22.	2. 30.	0. 18.	10. 4.	7. 52.	5. 58
29.	4. 15.	2. 21.	0. 9.	9. 55.	7. 46.	
31.		2. 13.		9. 45.	7. 37.	

Although

Although (for brevities sake) I have calculated this *Table* to every second day throughout the *Moneth*, yet you may have the time for every particular day, by substracting 4 *minuts* from the time the night before; and the remainder is the time for the night present.

For *Example*, Let it be the 8 day of *September*, is demaunded the hour of the night that *Orions Girdle* shall come to the *Meridian*.

First, look into the *Table* for the 7 day, (which is the day before) and right under *September* in the *Common Angle*, is 5 hours 35 *minuts* in the morning, the time that *Orions Girdle* shall come to the *Meridian* the 7 day, but it being the 8 day, therefore substract 4 *minuts*, and there remains 5 hours 31 *minuts*, the time in the morning that *Orions Girdle* will come to the *Meridian*, the 8 day of *September*.

Note, that any of the fixed *Stars* comes to the *Meridian* about 4 *minuts* sooner any night then the night before; that is, if any *Star* shall come to the *Meridian* at 6 clock in the morning, the next night the

said *Star* shall come 4 *minutes* sooner, that is, at
56 *minutes* past 5 in the morning: & the next
night after the like manner, as at 52 *minutes*
past 5, as in the *Table* with *Orions Girdle*
from the first to the third of *September*.

Note 2, From the first of *September* to
the first of *December*, *Orions Girdle* comes
to the *Meridian* after midnight, according
to the *Table*, which is marked with the
Letter *M*, signifying *morning*, and from
the first of *December* to the first of *March*,
before midnight, which is marked with
the Letter *A*, signifying *afternoon*.

A second Example, *December* the 19
day, is demaunded the *hour* or time that
Orions Girdle will come to the *Meridian*.
Look into the *Table* for the 19 day,
and right under the moneth *December*,
the *Common Angle* is 10 *hours* 39 *minutes*,
the time in the forenight desired.

Now, if it had been the 20 day, sub-
tract 4 *minutes* from the foresaid time (10
hours 39 *minutes*) and the remainder is 10
hours 35 *minutes*, the time in the forenight
that *Orions Girdle* will come to the *Meridian*
on the 20 day of *December*.

Thus

Thus I hope the meanest Capacity may easily know the hour or time that *Orions Girdle* will come to the *Meridian*, for the six *Moneths* foresaid in the *Table*: Here understand the middlemost of the three for there is 4 *minuts* time of difference between the first and the second, and the second and the third, that is, the first cometh to the *Meridian* 4 *minuts* before the second, and the second 4 *minuts* before the third.

It followeth now, how to know the hour of the night by the said *Orions Girdle*, it being upon any other point of the *Compass*, as betwixt *East* and *South*, that is before the *Meridian*, and *South* and *West*, that is, after the *Meridian*: for the said *Stars*, (at least) the first of them, riseth alwayes near the *East*, and seteth near *West*, because of their nearness to the *Equinoctiall*: so that there is alwayes near 6 *hours* from the time they rise, and their coming to the *Meridian*, and the like time from their being at the *Meridian* and seting: these things being premised, I come now to Practice.

January the 25 day, *Orions Girdle* was

H   pylled

pylled *South-West*, is demaunded the ⸥⸤ⁿof the night ?

First, look into the *Table* for the ⸤ⁿⁿday, and in the common *Angle* under ⸤ⁿⁿmoneth *Iannary*, you will find 8 ⸤ⁿⁿ00 *minuts*, the time that *Orions Girdle* (⸤ⁿmiddlemost of the three) shall come ⸤ⁿthe *Meridian*, now feeing that the faid ⸤ⁿ*rions Girdle* is at *South-West*, which is ⸤ⁿ*hours* paft the *Meridian*, therefore add ⸤ⁿ*hours* to the time they came to the *Meri⸤ⁿdian*, and it is 11 *hours* 00 *minuts* the tim⸤ⁿbefore midnight required : So that the ⸤ⁿday of *Iannar*, *Orions Girdle* being *Sou⸤ⁿWeft*, makes 11 aclock at night.

A second Example, *October* the 19 d⸤ⁿ*Orions Girdle* was pylled *Eaft-South-Ea⸤ⁿis demaunded the hour of the night?

First, you will find by the *Table*, th⸤ⁿthey will come to the *Meridian* at 3 ⸤ⁿclock in the morning, but feeing the f⸤ⁿ*Orions Girdle* is but *Eaft-South-Eaft*, wh⸤ⁿis 4 *hours* 30 *minuts* from the *Meridi⸤ⁿ(for fo we count 6 points) therefore ⸤ⁿcount 4 *hours* 30 *minuts* back from 3 acl⸤ⁿin the morning, and it makes 30 *min⸤ⁿ

... ast 10 aclock at night, the time required.

If you would know the time that the ... said *Orions-Girdle* will rise or set: Then ... first, find by the *Table* the hour or time ... their coming to the *Meridian*, and ... (then) adding 6 *hours* thereto, so have you ... the hour or time of their seting; and by ... substracting 6 *hours* therefrom, so have you ... is the time of their rysing.

For Example, Let it be the first of *December*, is demaunded the hour or time of ... rysing and seting of *Orions Girdle*?

First, you will find by the *Table*, that ... they will come to the *Meridian* 2 *minuts* ... ast midnight, to which if you add 6 ... hours, makes 6 *hours* 2 *minuts* in the morning, which is the time of their seting; ... by substracting 6 *hours* (or account 6 ... hours back,) makes 2 *minuts* past 6 in the ... afternoon, the time of their rysing: And ... thus you may find the time when *Orions-Girdle* will rise or set in the foresaid 6 ... moneths.

Note, that if the 32 *points* of the *Mariners Compass* were drawn upon all *Horizontall Dyalls*, (as it is upon some) then

might

might the hour of the night be know
by *Orions-Girdle*, (for the foresaid tim
as by the *Sun* by day, by pulling it as
foresaid: So that *Orions Girdle* is of
cellent use, not only to show the hour
the night, as is before shown, But also
to know the *Latitude* of the place, a
variation of the *Compass*, of which I sh
treat hereafter: but I come now to tre
a little as to reckon the *Tydes*, for I wou
strive to keep method.

CHAP. XIII.
To reckon the TYDES.

BEfore I begin with this small peece
Navigation, it will be fit to premi
some things as concerning it.

As first, Know that the *Flowing* an
Ebbing of the *Sea* dependeth much up
the *Moon*, for sure it is, that it kee
constant rule with the *Moon*. For consi
the time of *Fall Sea* any day of the
and you will find it the same time *F*
Sea, the same day of the next (or
other) *Moons*.

Secondly, Know that the same tim

Full Sea the Change-day, it is the same
time Full Sea the Full-Moon day: So that
the Change day, and the Full-Moon day, are
both alike as to the time of Full-Sea: Argue
then, it will be the same time Full-Sea
4 or 5 dayes (more or less) after the Full
Moon, that it is 4 or 5 dayes (more or
less) after the Change, that is, The same
time Full Sea the 20 day of the Moon, the
same time Full Sea the 5 day; and the 22
day as the 7 day, for the 20 and 22 day
of the Moon is as many dayes past the Full-
Moon, as the 5 and 7 is past the Change,
and so of the rest.

Thirdly, Know that we have always the
highest water (called Stream-Tydes) upon
the 2 and 3 day of the Moon, and the
like on the 17 and 18 day, and our low-
est water, (called Neip-Tydes) upon the
10 and 11 day of the Moon, and the like
upon the 25 and 26 day of the same Moon:
So that there is two Streams and two Neips
in every Moon.

Fourthly, Know that all along the Sea-
Coasts it Floweth 6 hours and 12 minutes and
Ebbs the same, but at the heads of most

Rivers, it *Ebbeth* longer then it *Floweth* be
cause of the Freshes.

Fifthly, Know that as the *Moon* is al
wayes 48 *minuts* of time latter in com
ing to any point of the *Heavens* (as to
Azimuth) where she was the night be
fore, even so is the *Full-Sea* any day 48
minuts latter then the day before; so whe
ever the *Moon* be any *Full-Sea*, she wi
always be there every second *Full-Sea*, an
at the opposite point the other *Tyde*: For
if the *Moon* be *South-West* the one *Full-Se*
she will be *North-East* the next, and so
South-West again the second; so that w
have always two *Floods*, and two *Ebbs* e
very 24 *hours* 48 *minuts*: Now where
ever the *Moon* be at *Full-Sea* in any place,
we commonly call that point of the *Compa*
the *Flowings* of the place.

Example, At *Dundee*, a *South-West* b
South Moon maketh ever *Full-Sea* the on
Tyde, and a *North-East by North Moon* th
other *Tyde*; and so it is said to *Flow*
Dundee South West by South and *North-E*
by North, and the like with any othe
Thus having premised these things, I co
Practice.

Dundee, where it *Flows South-West by South*, the *Moon* being 5 dayes old, is demaunded the time of *Full-Sea?*

First, Confider that when the *Moon* to 5 dayes old, fhe is 5 *points* 15 *minuts* from the *Sun*, therefore account 5 *points* 48 *minuts* from *South-West by South* to the right hand, and you will find the *Sun* 15 *minuts* paft *Weft*; which makes 15 *minuts* paft 6 aclock at night, the time defired.

A second Queftion, At the fame place, the *Moon* being 22 dayes old, is demaunded the time of *Full-Sea?*

First, Confider that there is 8 *points* 24 *minuts* betwixt the *Sun* and *Moon*, and feeing the *Moon* will be *South-Weft by South* at *Full-Sea*, therefore account 8 *points* 24 *minuts* from *South-Weft by South* to the left hand, and you will find the *Sun* at that time to be *South-Eaft by Eaft* 14 *minuts* *Eafterly*; which makes 51 *minuts* paft 7 aclock in the morning, the time of *Full-Sea* defired.

So that this way of reckning of *Tydes*, differs nothing from the former way, fhown to find the hour of the night by the *Moon*,

notwith

notwithstanding this last *Question* might have been resolved thus, by reckning to the 7 day 6 (for so it will hold) and so accounting 7 *points* 21 *minuts* from *North East by North* to the right hand, and you will find the *Sun* at *East South East* 21 *minuts Southerly*, which *Sun* makes 51 *minute* past 7 in the morning, the same time with the former: And likewise you may account 7 *points* 21 *minuts* from *South West by South* to the right hand, and you will find the *Sun* at *West North West* 21 *minuts Northerly*; which makes 51 *minuts* past 7 at night, so by inverting the time is the same with the former: This is a good old way to reckon the *Tydes*, notwithstanding take this second way now most in use.

First, Consider the *Change day* and *Full Moon*, when it is *Full-Sea*, and for every day thereafter (either *Change* or *Full-Moon*) add 48 *minuts* of time, to the time of *Full-Sea* either *Change* or *Full-Moon*, so have you the time of *Full-Sea* for any day of the *Moon*.

For Example, Where it floweth *South West by South*, the *Moon* being 5 dayes old, is demaunded the time of *Full-Sea*.

First, Confider where it *Floweth South-* *Weſt by South*, it is alwayes *Full-Sea* the *Change day* and *Full-Moon* at 15 *minuts* paſt 2 aclock, now feeing it is 5 dayes paſt the *Change*, therefore it will be 4 *hours* latter *Full-Sea* then the *Change day*, (for 5 dayes difference of the *Tyde* at 48 *minuts* each day is 4 *hours*) which makes 15 *minuts* paſt 6, the time of *Full-Sea* required, which you may order thus.

	ho. min.
The time of Full-Sea *the* Change-day,	2. 15.
5 *dayes ſince at* 48 min. *each day*,	4 0.
Full-Sea *either morning or night.*	6 15.

Note, That when ever the *Moon* maketh *Full-Sea* at any place (commonly called the *Flowings*) fee what hour or time of the day it is when the *Sun* is upon the fame point of the *Compaſs*, and that is the time of *Full-Sea* the *Change-day* or *Full-Moon*: as in the foregoing queſtion, where it *Floweth South-Weſt by South*, now a *South-Weſt by South Sun* maketh 2 *hours* 15 *mi-nuts*, being the time of *Full-Sea*, the *Full-Moon* or *Change*: and the like of any other.

I

The second Question, Where it *Floweth* South-East the *Moon* being 8 dayes old is demaunded the time of *Full Sea?*

	ho.	m.
The time of Full=Sea *the* Change-day,	9.	00
8 *dayes since at* 48 min. *each day*	6.	24
	15.	24
Substract	12.	00
Full Sea either morning or night.	3.	24

Here you see that the *Full-Sea* will be at 24 *minuts* past 3 aclock, and may without great difference be either morning or night.

Note, That if the *Moon* were 23 dayes old, it is the same time *Full-Sea* that is here with the 8 day, for as I proved before, that they are both alike as to the time of *Tyde*.

The third Question, Where it floweth West-South-West, the *Moon* being 21 dayes old, is demaunded the time of *Full=Sea?*

	ho.	m.
The time of Full=Sea *the* Full-Moon,	4.	30
8 *dayes since at* 48 min. *each day,*	4.	48
Full-Sea	9.	18

Here you see that the *Full-Sea* will at

minuts paſt 9 , and the ſame time *Full-Sea* the 6 day, and the like with any other.

CHAP. XIV

To find the variation of the Compaſs.

IF you would know whether your *Com-paſs* be good or not, take theſe three wayes following?

As firſt, See if the *Sun* by your *Com-paſs* ſets as many *degrees* to the *North-wards* or *South-wards* of the *Weſt*, as it did riſe to the *North-wards* or *South wards* of the *Eaſt*? then is your *Compaſs* good; that is, if the *Sun* riſe *Eaſt-North-Eaſt*, and ſet *Weſt-North-Weſt*, or riſe *Eaſt-Souih-Eaſt* and ſet *Weſt-South-Weſt*, *Argue* your *Com-paſs* is good: for the *points* of ryſing and ſet-ting of the *Sun*, is alwayes alike diſtant from the *Meridian*.

Secondly, If the ſhaddow of the *Sun* be-ing *South-Weſt*, be equivalent to the ſhad-dow at *South-Eaſt*, then is your *Com-paſs* good.

To perform which, *Firſt*, fix any *Table* or *Chiſt* as *Horizontall* as you can, and ſet up any ſmall peece of *Wood* or *Weir*, or

any

any other thing in manner of a *Gnomon*, as perpendicular as you can, and when the *Sun* is *South-East* remark the length of the shaddow, and if the shaddow be the same length at *South-West*, *Argue* the *Compass* is good: the like may be used with *East-South-East* and *West-South-West*, or *East* and *West*, or with any two points that are a-like distant from the *Meridian*.

Thirdly, If you find the first of *Orions Girdle* to rise *East*, or to set *West*: then is your *Compass* good, for that *Star* riseth alwayes *East*, and seteth *West*, over all the *Earth*: This *last* and the *first* may be used at *Sea*, but the *second* only at *Shore*.

Now it remaineth that we show when the *Compass* hath variation, how much the variation is, and which way it is: which I shall do by answering these questions: *Observing*, that if the *Compass* varie to the right hand, we call it *Easterly variation*, and if it varie to the left hand, we call it *Westerly variation*.

The first Question, Admit the *Sun* was found to rise *East-North-East*, and the same day was found to set *North-West*, is de-
maunded

maunded as aforesaid?

Now sure it is, that the true *Meridian* is alwayes in the middle betwixt the points of rysing and seting, which here you will find to be *South by West*, (for *South by West* is the middle point betwixt *East-North-East* and *North-West*) so that the *South by West* point of the *Compass* pointeth out the *Meridian* or *South*. Now if the *South by West* point of the *Compass* be but *South*, then *Argue*, the *Compass* hath varied to the left hand a whole point, called *Westerly-variation*.

The second Question; Admit the *Sun* be found to rise *North-East by East*, and the same day was found to set *West-North-West*, is demaunded the *Compass variation*?

Here you will find the *Meridian South* half *Easterly* (it being the middle betwixt the two aforesaid points) now if the *South* half *Easterly* point of the *Compass* be but *South*, then *Argue*, the *Compass* hath varied half a point to the right hand, called *Easterly variation*.

The third Question, By the *Suns Azimuth* at two *Altitudes*: In one day the
shaddow

shaddow of the *Sun* being *West* was equivalent to the shaddow at *East-South-East*, is demaunded as aforesaid?

Here you will find the *Meridian* to be *South by West*, it being the middle betwixt the two aforesaid points: now if the *South by West* point of the *Compass* be but *South*, then *Argue*, the *Compass* hath varied to the left hand a whole point, called *Westerly variation*.

The fourth Question, By the first of *Orions Girdle*: Admit the first of *Orions Girdle* was pylled to rise at *East-North-East*, is demaunded the variation?

Now as I said before, that the first of *Orions-Girdle* riseth alwayes *East*, and seteth *West* over all the Earth; then *Argue*, the *East-North-East* point of the *Compass* is but *East*, which showeth that the *Compass* hath varied two points to the right hand, called *Easterly variation*.

The fifth Question; Admit the first of *Orions Girdle* was found to set at *West by South*, is demaunded the variation? Here the *West by South* point of the *Compass*, is but the true *West*, so *Argue*, the *Compass* hath

hath varied a point to the right hand, called *Easterly variation*: So by these three wayes may the meanest capacity know the variation of the *Compass*; Notwithstanding the two last wayes (which are soonest performed) now most in use by them that are learned in *Navigation*, is by the *Suns Amplitude*, and *Azimuth* at a convenient hight, having for the *First*, their is given the *Latitude* and *Declination* to find the *Amplitude*: and for the *Second*, there is given the *Latitude*, *Declination* and *Altitude*, to find the *Azimuth*: Each of these may be resolved in *Geometry* and *Sphericall Trigonometry*, to treat of which, is not my design in this place: Notwithstanding *Reader*, if you be acquanted with the Artificial *Tables* of *Signs*, or the line of *Signs* on *Gunters Scale*; take here the *Canon* for the *Suns Amplitude*. As the *Sign Complement* of the *Latitude* is to *Radius*, so is the present *Declination* to the present *Amplitude*; that is, add the *Sign* of the *Suns Declination*, to the *Sign* of 90; and from that product substract the *Sign* of the *Complement* the *Latitude*, and the remainder

is the *Sign* of the *Amplitude*.

As in the *Latitude* of 56 deg. 00 min. the *Sun* having *North Declination* 15 deg. 13 min. the *Amplitude* will be found to be 28 deg. 00. min. which is *East-North-East* half a point *Northerly*, and by the *Gunter-Scale*, extend the *Compass* from 34 deg. to 90 deg. the same distance will reach from 15 deg. 13 min. to 28 deg. the *Amplitude* as before.

Now it followeth how to order a *Course* upon a *Compass*, that varieth either *Easterly* or *Westerly*; and to rectify a *Course* already sailed.

Admit, I am to sail *South-East* by a *Compass* that varieth two points *Westerly*, how shall I sail? *Answere*, *South-South-East* for that represents *South-East*.

Admit I am to sail *North-East* upon a *Compass* that varieth a point *Easterly*; how shall I sail? *Answere*, *North-East* by *North*, for it represents *North-East*.

Admit I have sailed *South-East* by a *Compass* that varieth two points *Westerly*, how have I sailled? *Answere*, *East-South-East*, for *South-East* here represents *East-South-East*.

Admit

Admit I have failed *East-North-East*, by a *Compass* that varieth a point *Easterly*, how have I sailed? *Answere*, *East by North*, for *East-North-East* here, representeth *East by North*.

CHAP. XV.
The use of the Plate or Plain Chart.

*A*Lthough this *Chart* may seem at first to the unlearned to be a confusion of lines as seeing so many lines crossing one an other, notwithstanding when rightly considered, you will find every line running exactly parallel to another, that is, all *North* and *South lines*, *East* and *West lines*, and so consequently all the other points of the *Compass* runs all parallel the one to the other.

Also every line hath (as it were) two names, *to wit*, *North* and *South*, *East* and *West*, *North-East* and *South-West*, and so of all the rest of the *Compass*.

Example of the *North* and *South* line, as it comes off *North* from one *Compass*, so it comes off *South* from the other; and the *East* line from one *Compass* runs off

K   *West*

West from the other, I mean their oppof...
Compasses: Now the like you will find wi...
all the 32 points, and the *North* and *South li*...
runing betwixt any two *Compasses*, is alway...
parallel to any *North* and *South line*, runin...
betwixt two other *Compasses*, & so all the re...

The 8 great points of the *Compass*...
commonly thicker lines then the rest,...
the other 8 points that divides them a...
commonly pricked lines; and the other 1...
points are smaller lines, and thus they a...
for the more quicker knowing of them.

There is commonly on the margent, th...
degree of *Latitude* of these places on th...
Chart, each *degree* being alwayes equall...
20 *Leagus* on the *Scale*.

This *Scale* of *Leagues* you will alway...
find upon some corner of the *Chart*, cómo...
ly marked 5. 10. 20. 30. 40. and so forth...

These *degrees* of *Latitude* are commonl...
divided In 4. 5. or 6. divisions, if in...
parts each part is 15 *minuts*, and if in...
parts, each part is 12 *minuts*, and if in...
parts, each part is 10 *minuts*, the whol...
being alwayes 60 *minuts*.

The uses of this *Chart* are these.

Fir

First, To find the courſe and diſtance alongſt any ſhore.

Secondly, To find the courſe and diſtance betwixt any two Lands.

Thirdly, Having traveſed a while at *Sea* by contrary winds, to know at all times how the Land is bearing of you, you are bound to, and your diſtance from it, and alſo, any other place upon the *Chart*.

Fourthly, To know the *Latitude* of any place upon the *Chart*.

For the firſt, If you would know the courſe and diſtance alongſt any ſhore, then with a pair of *Compaſſes* look what line leadeth neither off the ſhore nor on upon it, and that is the courſe line along that ſhore; or lay a ruler alongſt the ſaid ſhore, and look what line is neereſt parallel to your ruler, and that is the courſe line alongſt that ſhore: Or ſuppoſe a line runing alongſt that ſhore from one point to another; and look what line is neareſt parallel to that ſuppoſed line; and that is the courſe line foreſaid, then with your *Compaſſes* take off the diſtance and apply to the *Scale*: So thus you may find the courſe

K 2

and

and distance alongst any shore.

Example, Look upon any true *Chart*, and you will find the nearest course along[st] shore, from without the *Read head* to [Bu]chan-ness, is *North North-East* a little Ea[st]erly, about 18 or 19 *Leagues*.

And also from the *Skair heads* to *Flem[borough head*, is *South-South-East* half a point Easterly distant 40 *Leagues*.

Secondly, For the course and distance betwixt any two *Lands*, you will find it the same way as the former, for if you lay a ruler, or suppose a line from the *Island* of *May* to the *Noas of Norway*, and you will find the nearest parallel line to be *East by North* a little *Northerly*, which is the nearest course from the *Island* of *May* to the *Noas of Norway*; and so consequently *West by South* a little *Southerly*, leadeth from the *Noas of Norway*, to the *Island* of *May*, and the distance being applyed to the *Scale* will be 103 *Leagues*.

Likewise, if you lay a ruler from *Buchan-ness* to the *Sualheads of Norway*, you shall find the nearest parallel line thereunto to be the *North-East by North* and *South-*

West by *South* line, which is the nearest
course leading betwixt these two places;
or you may find the same with a pair of
Compasses, and then with your *Compasses*
take off the distance, and apply to the *Scale*,
and it will be found to be 100 *Leagues*:
So thus you may find the course and dis-
tance betwixt any two Lands contained in
the *Chart*.

Thirdly, For traversing, know that it is
not my intention here, to treat of that
method and exactness, that is used in long
voyages, for it would not be suitable to
the place: I shall onely treat a little
of that ordinary method and way used in
short voyages.

First, Remark the day of the moneth,
and the hour of the day, that you depart
from any *Land*, and how it bears from
you, and the distance by estimation; and
thereafter keep an exact accompt of every
watch runing, as to course and distance;
which courses and distances being set off
upon the *Chart*, gives alwayes the point
or prick on the *Chart* where the *Ship* is.

Now if you would know the *Latitude*
of

of any place on the *Chart*, then with your
Compasses take off the distance to any *East*
and *West* line, and with the same distance
follow that line to the margent, (or any
other *North* and *South* line, where the *de-
grees of Latitude* are set down) and
mark the *degree* and *minut* where the foot
of your *Compasses* riseth, and that is the
Latitude of the place.

The same may be done by laying a
ruler from the said place, parallel to any
East and *West* line: So if you take the
distance of *St. Tabes-head* from any *East*
and *West* line, and with that distance fol-
low that line to the margent, and you
will find 56 *degrees* 4 *minuts*, which is
the *Latitude* of that place, or lay a ruler
by *St. Tabes-head* parallel to any *East* and
West line gives the same.

If you do the same with *Buchanness*,
you will find the *Latitude* of 57 *degrees*
46 *minuts*, the nearest *Latitude* of that
place.

Example of ordering a reckning at Sea

April the 3, being *munday* 1682, we
parted from the *Island* of *May* in *Scot-
land,*

..., bound (God willing) for the *Noze*
... *Norway*, and at 4 aclock at night the
... Island of *May* bear *West-South-West* dis-
... 6 *Leagues*, and we sailed as followeth.

				Leagues
From	4 *to* 8	E *by* N,		6
	8 *to* 12	E *by* N,		5
	12 *to* 4	E *by* N,		7
	4 *to* 8	E *by* S,		5
	8 *to* 12	E *by* N,		5

Which 5 *Watches* sailing we common-
ly order thus, the first 3 *Watches* and the
last *Watch* being all one way, is *East by*
North 23 *Leagues*, and the 4 *Watch* being
East by South 5 *Leagues*, so thus the 5
Watches sailing is reduced to two severall
courses and distances, to wit, *East by*
North 23 *Leagues*, and *East by South* 5 *Leagues*;
which courses and distances is set off upon
the *Chart* as followeth.

First, Take 6 *Leagues* of the *Scale*, and
fix one foot of your *Compasses* at the *Island*
of *May*, and set the other foot paral-
lel to an *East-North-East line*, which you
may do by taking a pair of *Compasses*, and
take the distance of the first foot from
the

the nearest *East-North East line*, and so
seting the second foot alike distant from
the same line, (which makes a true paral-
lel,) and so have you the prick or point
on the *Chart* where the *Ship* was at 4 a-
clock at night, the time of departure.

Then take 23 *Leagues* off the *Scale*, and
fix one foot of your *Compasses* in the fore-
said prick or point, and so with your o-
ther pair of *Compasses*, take the distance
of the first foot from the neerest *East by
North line*, and so seting the second foot
alike distance from the same line, and re-
mark that second prick or point: Then
take 5 *Leagues* of the *Scale*, and fix one
foot of your *Compasses* in the last prick or
point, and set the other foot parallel (as
aforesaid) to an *East by South line*; and
so have you the prick or point on the *Chart*
where the *Ship* was at 12 aclock next day,
which if exactly set off from the *Island of
May*, (as aforesaid) you will find
that the *Island of May* bears now from
the *Ship West by South*, a little *Westerly* dis-
tant 33 *Leagues*, and the *Noss of Norway*
bearing *East by North* a little *Northerly*

distant

distant 70 *Leagues*, and the *Ship* now in the *Latitude* of 56 degrees 32 *minuts*, and this will be the place of the *Ship*, on *Tuesday* at midday, being the 4th of *April* 1682.

April the 4th at midday 1682, the *Noas of Norway* being by estimation bearing *East by North* a little *Northerly* distant 70 *Leagues*, and we sailed as followeth.

			Leagues
From	12 to 4	N. E.	5
	4 to 8	E. N. E.	5
	8 to 12	East.	5
	12 to 4	East.	6
	4 to 8	E. by N.	6
	8 to 12	West.	3

Which 6 *Watches* is ordered thus: the first two makes *North-East by East* 10 *Leagues*, the third, fourth and sixth *Watches* is *East* 8 *Leagues*, (for the third and fourth being *East* 11 *Leagues*; and the sixth *West* 3 *Leagues*, therefore substract 3 *Leagues West*, from 11 *Leagues East*, and there remains 8 *Leagues East*) then is there *East by North* 6 *Leagues*, so thus the six *Watches* sailing,

L

is reduced to three several courses and di-
tances, to wit,

	Leagues
N. E. by E.	10
East	8
E. by N.	6

Which 3 severall courses and distances,
if you set off upon the *Chart*, (as former-
ly is taught) and so have you the prick
or point on the *Chart* where the *Ship* is
12 aclock next day; which if exactly set
off from the place the day before, you
will find that the *Noas of Norway*, beareth
now from the *Ship East by North* a little
Northerly, distant 46 *Leagues*, and the *is-
land of May* bearing *West by South* dis-
tant 57 *Leagues*, and the *Latitude* of 56
degrees 54 minuts.

And thus you may find the *Ships* place
on the *Chart* at any time, and how every
Land on the *Chart* bears from you, and your
distance from it; I leave the rest to your
own practice.

CHAP. XVI.

CHAP. XVI.

To find the Latitude the Ship is in, by Observation.

First, It will be fiting to premise certain things serving to that purpose, and forasmuch as there is severall sorts of Instruments made use of at *Sea*, for finding the *Meridian Altitude* of *Sun* or *Star*, I shall onely treat of finding the *Sun* or *Stars Altitude* by a *Fore-staff*.

The *Fore-staff* is made streight and four square, and commonly made of *Box* or *Pear-Tree*; and some of *black-Iben*, and graduated on the severall sides, with *degrees* and *minuts*.

The *Crosses* are usually four, as one for each *square*, and commonly made of the same Wood with the *Staff*, of a convenient breadth and of length, proportionable to the *Graduations*; so fited to slide evenly upon the *Staff* without joging.

On the one side of the *Staff* the *Graduations* begin about 3 *degrees*, and proceedeth to the Eye end encreaseth by every ten *minuts* to ten *degrees*, and this side is called the tenth side; and the *Cross* belonging thereunto

unto (the shortest of the four) the tenth Cross,
whose length will reach on this side from
10 degrees to 8 degrees 31 minuts.

On an other side of the Staff, the Gra-
duations begin at ten degrees and increaseth
upwards to 30 degrees, this is called the
thirty side, and its Cross the thirty Cross,
whose length will reach on this side from
30 degrees to 19 degrees 47 minuts.

On another side the Graduations begin
about 20 degrees, and increaseth towards
the Eye end of the Staff to 60 degrees, this
is named the sixty side, and the Cross pe-
culiar to this side, is called the sixty Cross,
whose length will reach on this side from
60 degrees to 30 degrees.

The remaining or fourth side, the Gra-
duations begin at 30 degrees and increaseth
to the Eye end to 90 degrees; from thence
it is named the ninty side, and the Cross
(being the longest) the ninty Cross, whose
length will reach on this side from 90
degrees to 36 degrees 52 minuts; and the
half length from the Eye end to 90 degrees.

There is other Forestaffs that are comonly
made of black-ibon, with Pear-Tree Crosses.

On

On the one side of this *Staff*, the *Graduations* begin at 8. *degrees*, and increaseth to the Eye end to 30 *degrees*, the *Cross* as the 30 *Cross* in the former.

On another side the *Graduations* begin about 18 *degrees*, and increaseth to the Eye end to 60 *degrees* the *Cross* being alike to the sixty *Cross* in the former.

On another side is the short ninty, the *Graduations* begin at 30 *degrees*, and increaseth to the Eye end to 90 *degrees*, the *Cross* reacheth as the ninty in the former.

The remaining or fourth side, is called the long nyntie side, the *Graduations* begin about 40 *degrees*, and increaseth to the Eye end to 90 *degrees*; the *Cross* (being the longest) reacheth as the former.

Most or all *ForeStaffs* are marked with the *Complement* of the *Altitude*, as by stands 70, and by 30 stands 60, and by 40 is 50, and so of the rest: That is, if the *Sun* be 20 *degrees* high, he is 70 *degrees* from the *Zenith*, and lykewise being 30 *degrees* high, is 60 *degrees* from the *Zenith*; so what ever be the *Suns* highte, it being substracted from 90, the re-

remainder is the distance from the *Zenith*, called the *Complement* of the *Altitude*.

The *degrees* and *minuts* of *Altitude* increaseth to the Eye end, and the *Complement of Altitude* increaseth from it; for the higher the *Sun* the nearer the *Zenith*: So that when you work your observation as to obtain the *Latitude*, you may make ufe of the *Altitude*, or *Complement of Altitude*, being all to one purpofe.

When you are to take your observation, as for finding the *Meridian Altitude*, in reference to the obtaining of the *Latitude* of the place, it is convenient, that you be preparing your felf for your observation fome competent time before *noon*; and confider what may be the *Suns* greatest *Altitude* that day, accordingly to ufe thofe *Croffes* that may be moft fuitable to your purpofe: As fuppose the *Meridian Altitude* for that day, be judged to be about 30 *degrees*, then ufe the thirty fide, and the thirty *Cross*, and if you think it will be 30 *degrees*, and above it, then take the fixty *Cross*, but if you efteem it to exceed both, then ufe the nyntie fide and *Cross*.

To

To take a foreward observation of the Suns Meridian Altitude at Sea.

HAving provided your *Cross*; that is most fiting for your purpose that day, slide it one upon your *Staff* with the Nut out most, then with your right hand, present the *Staff* to the out side of the corner of your right Eye, as near your Eye as conveniently you can, without hindering the sight, let the end of your *Staff* rest upon the Eye bone, parallel as it were with the Eyes Center, and then is your *Staff* rightly placed for observation.

The *Staff* being thus holden to your Eye, turne your face to the *Sun*, holding the *Cross* as upright as you can, looke at the upper end of your *Cross* for the *Sun*, and at the lower end for the *Horizon*; but if the *Sea* obscureth the *Horizon* from your sight, then remove your *Cross* a little farther from your Eye, but if on the contrary your sight do not extend so low as the *Horizon*, but that the skie appears in stead thereof, then remove the *Cross* a little nearer to your Eye, untill by the upper

end thereof you see the Center of the *Sun,*
and by the lower end the *Horizon* exactly
at the same time, then look upon the pro-
per side of the *Staff* (belonging to the *Cross*
you use) the *Suns Meridian Altitude* will
be cut by the same, and thus you may
observe the *Sun* or *Stars Meridian Altitude*
with a *Forestaff.*

Note, That it is fit you begin your ob-
servation at a *South-South-East,* or *South
by East Sun,* still making observation as your
judgement shall direct you, untill the *Sun*
be upon the *Meridian,* still holding the *Cross*
nearer to your Eye as the *Sun* riseth, and
when you perceive him to be at the high-
est, then look for the *degree* and *minute* up-
on the proper side of the *Staff* as afore-
said, so have you the *Meridian Altitude* of
the *Sun.*

Note 2*dly,* That if you make observa-
tion of the *Sun* after he is to the *West-ward*
of the *Meridian* you will find the *Sea* by
the lower end of your *Cross,* to obscure
the *Horizon* from your sight, and then you
may know the *Sun* is falling.

Note 3*dly,* That the Center of the
Sun

Sun, is the true place of the *Sun*, and therefore there is commonly a peece of red glaſs (holden with the left hand) to defend the Eye from the *Suns luſter* in time of obſervation ; but I think its as good to take the upper edge of the *Sun* in obſervation, and rebate 16 *minuts* from the *Altitude*.

To make a backward obſervation of the Suns Altitude *by a* Foreſtaff.

THeſe *Obſervations* are frequent at *Sea*, and to perform this, you muſt have a *Horizon vane* to fix upon the Eye end of the *Staff*, (or elſe a ſliding on according to the *Dutch faſhion*) likewiſe there is a Shoe of braſs to fit on the end of any of the *Croſſes*.

Then place your *Horizon vane* upon the Eye end of your *Staff*, and put on a *Croſs* fiteſt for your purpoſe, fix the *braſs-Shoe* at the lower end thereof, then turn your back to the *Sun* ; and looking through the ſight (made by the *Braſs-Shoe*) on the end of your *Croſs*, raiſe or let fall the end of your *Staff*, untill the ſhaddow made by

M

the upper end of the *Cross* fall upon the
upper part of the fight in the *Horizon vane*,
then look thorow that fight for the *Horizon*, but if the *Sea* obscure the *Horizon* from
your fight, then remove your *Cross* a little
nearer the *Horizon vane* : but if on the
contrary, your fight doth not extend so
low as the *Horizon*, but the *Sky* appears in
stead thereof, then remove the *Cross* further from the *Horizon vane*, till you see the
shaddow fall upon his due place, and perceive the *Horizon* exactly at the same time;
then look upon the propper side belonging
to that *Cross*, and you will find the *Meridian Altitude* cut by the same, and its
Complement.

It you observe for the *Latitude*, you must
keep observing (as is aforsaid) till the
Sun be past the *Meridian*, and so desist.

Now as for finding the *Latitude* by
the *Suns Meridian Altitude*, or the *Complement* thereof, shall be spoken to hereafter.

The other way to use this *Staff* in a backward observation, is by having an *Horizon vane* to slide evenly upon the *Staff* ;
and

and then all the variety from the former manner of observation, will be this, place any of your *Crosses* that you intend to use upon the *Center* (or Eye end) of the *Staff*, turning the Nut inwards, then slide on your *Horizon vaen*, with the Nut inwards, and fix on the *Brass Shoe* at the lower end of your *Cross*; then proceed with your observation, removing the *Horizon vane* as before you did the *Cross*, and the *degrees* and *minuts* cut by the Edge of the *Horizon vane* upon the side peculiar to the *Cross* you use, is the *Suns Altitude* and *Complement* thereof.

So thus you may find the *Suns Meridian Altitude* or *Complement* thereof, by a foreward or backward observation of the *Fore-staff*.

The next thing to be known, as to obtain the *Latitude*, is the *Suns declination*, the which you will find in most, or all *Navigation books*, there being in them *Tables* of the *Suns Declination*, for every day throughout the Year.

If you would find the *Suns Declination*, for any day of the moneth in these *Tables*

first

first consider, what Year it is in reference
to *Leap-Year*, then look for the day of the
moneth on the left hand, and the moneth
at the top, and right from the day of the
moneth in the *Common Angle* under the
Year, is the *Suns Declination* in degrees
and *minuts.*

For Example, On the 20 day of *April*
1682. is demaunded the *Suns Declination*

First, Look into the *Table* at the left hand
for the 20 day, and the moneth *April*
at the top, and the second Year from *Leap-
Year* (for so is the 1682 Year) and right
in the *Common Angle* is 14 *degrees* 57 minuts *North*, being the *Suns Declination* at
that time.

Note, That the Sun hath *North Declina-
tion* from the 9 of *March*, to the 12 of
September, and *South Declination,* from the
12 of *September*, to the 9 of *March.*

So that to us in *North Latitude,* when
the Sun hath *North Declination,* is above
the *Equinoctiall,* and having *South Declina-
tion* is below it.

Latitude, is the *Equinoctiall distance* from
the *Zenith*; so that the hight of the *E-
quinoctiall*

equinoctiall is the *Complement of the Latitude.*

The *Sun* or *Stars Declination* is their distance from the *Equinoctiall,* either *Northerly* or *Southerly,* having premised these things come to practice.

To work an Observation.

April the 20 day 1682, the *Suns Declination Northerly* being 14 degrees 57 minuts, the *Suns Meridian Altitude Southerly,* was found to be 50 degrees 10 minuts, is demaunded the *Latitude?*

Substract the *Suns Declination* from the *Meridian Altitude,* and the remainder being substracted from 90, leaveth the *Latitude,* which commonly we do with a pen, or peece of chalk, thus.

	deg.	min.
The *Meridian Altitude Southerly*	50	10.
The *Suns Declin North* substracted	14.	57.
The *Equinoctialls hight*	35.	13.
The which being substracted from	90.	
	35.	13.
Latitude North	54.	47.

Here you see that when the *Suns Declination* is substracted from the *Meridian Altitude,* there remains 35 *degrees* 13 minutes

nuts the hight of the *Equinoctiall*, that being substracted from 90, leaveth 54 degrees 47 *minuts*, being the *Latitude North*.

Although, for the better understanding it, I write the *Meridian Altitude*, and *Declination*, and the rest, yet at Sea we set down nothing but the figurs.

October the 10 day 1682, the *Suns Declination Southerly* being 10 degrees 33 *minuts*, the *Suns Meridian Altitude South*, was found to be 28 degrees 20 *minuts*, is demaunded the *Latitude*?

To resolve this, Add the *Suns Declination* to the *Meridian Altitude*, and that sume substract from 90, leaveth the *Latitude*, which is done thus;

	de.	min.
The *Meridian Altitude Southerly*,	28.	20.
The *Suns Declination South* added,	10.	33.
The *Equinoctialls* hight,	38.	53.
The which being substracted		
From	90.	00.
	38.	53.
Latitude North.	51.	7.

Here you see, that the *Suns Declination* being added to the *Meridian Altitude*, gives

be gives 38 *degrees* 53 *minuts*, for the hight
of the *Equinoctiall*, that being substracted
from 90, leaveth 51 *degrees* 7 *minuts*, the
Latitude required.

After the same manner is the *Latitude*
found by the Stars, having their *Meridian
Altitude* and *Declination*.

Now having showen how to work an
observation within the bounds of *Europe*,
by the *Meridian Altitude* of either *Sun* or
Star, it will be fitting to treat a little of
finding the *Latitude* by the *Complement* of
their *Meridian Altitude*.

If the *Sun* have *North Declination*, add
it to the *Complement* of the *Meridian Alti-
tude Southerly*, so have you the *Latitude*:
And if the *Suns Declination* be *Southerly*,
substract the *Suns Declination* from the *Me-
ridian Altitude Southerly*, so have you the
Latitude.

Example, In the former question, of *A-
pril* the 20 day 1682, the *Complement* of
the *Meridian Altitude* being 39 *degrees* 50
minuts, to which if the *Declination* be ad-
ded, giveth 54 *degrees* and 47 *minuts*, the
Latitude as before.

Also

Also of the other, in *October* the 10 d.
1682, the *Complement* of the *Meridian*
Altitude, being 61 degrees 40 minuts, from
which substract the *Suns Declination* 10 de-
grees 33 minuts, and there will remain
51 degrees 7 minuts, being the *Latitude* as
formerly.

C H A P, X V I I.
To find the Latitude by Orions-Girdle.

IF you observe the first of *Orions Girdle*
upon the *Meridian* in the *South*, add to
the *Meridian Altitude*, 35 minuts, and sub-
stract that sume from 90, and what remains
is the *Latitude*.

Example, Admit the first of *Orions-Girdle*
was at the *Meridian* in the *South*, to be 34
deg. 30 min. is demaunded the *Latitude?*

The Operation.	deg.	min.
The *Meridian Altitude* Southerly, is,	34.	30.
The *Declination Southerly*,	00.	35.
The *Equinoctialls hight*, or *Complement* of the *Latitude*.	35.	05.

Here you see that the *Declination* of the
Star 35 minuts, being added to the *Meri-*

dian Altitude 34 *degrees* 30 *minuts* , gives 35 *degrees* 5 *minuts* , for the hight of the *Equinoctial* or *Complement* of the *Latitude*, the which being substracted from 90, leaves 54 *degrees* 55 *minuts*, the distance of the *Equinoctial Southwards* from the *Zenith*; or the *Latitude Northerly*: And thus you may find the *Latitude* by *Orions Girdle*, which if the *Horizon* be clear will serve your purpose alse well as the *Sun*; and so much for finding the *Latitude* by the *Meridian Altitude* of *Sun* or *Star*, within the bounds of *Europe*, but more of this hereafter.

CHAP. XVIII.

What Moon *maketh* Full-Sea *in severall places in the* North-Seas.

A T *Lieth, Dundie, Berwick, Brunt-Island, Holy-Island*, a *South-West by South*, and *North-East by North* *Moon*, make h *Full-Sea.*

Montrose , the *Out-end of Tay* , St. Andrews , and all along the *Coast* , from th *Car* to *Kinghorne-ness*, before the *Maci Gourie*, and *Terveer, South-South-West*, an *North-North-East.*

Aberdee

Aberdeen, *Flushing*, the *Nower*, *South by West*, and *North by East*.

London, *Inder-keibing*, *Scare-burgh*, *Amsterdam*, *Roterdam*, before *Tinmouth*, *South West*, and *North-East*.

Buchan-ness, and all the *South side of the Murray Firth*, at *Deall*, *Dover*, *Dunkirk*, and all along the *Swin to the Shoe*, *South and North*.

All above the *High-land in the South Firth*, *South West by West*, and *North-East by East*.

A little off the shoar before *Humber*, *Flamborough*, and *Scairs-brough*, *West-South-West*, and *East-North-East*.

At *New-Castle*, the *Spurn*, and *Humber*, *West by South*, and *East by North*.

At *Hull*, *Tessel*, and *Hambrough*, *East, and West*.

At *Orkney*, before *Cromer*, *Winterton*, and *Yarmouth*, *South-East*, and *North-West*.

At *Leytaff* *Orfordness*, and *Alborough*, *South-East by South*, and *North-West by North*.

At *Harwich* *Yarmouth*, and *Brasse-sound*, *South-South-East*, and *North-North-West*.

CHAP.

CHAP. XIX.

The Courses and Distances, alongst west
shoars, in the North-Seas.

Leagues

FRom *Tay* to the *Car*, South-South-East 4,

From *Tay* to *Inch-Cape*, East,
half Southerly.   4.

From *Tay* to the *Read-head*, North-East
by North.   3.

From *Read head* to *Tod-head*, North=
North-East half Easterly.   4.

From *Tod head* to *Aberdeen-ness*,
North-North-East.   7.

From *Aberdeen-ness* to *Buchan-ness*,
North-North-East a little Easterly.   9.

From *Buchan-ness* to *Ratre-head*,
North.   3.

From *Ratre-head* to *Kinnairds-head*,
North-North West a little Northerly.   2.

From *Kinnairds-head* to *Cromerty*,
West nearest.   18.

From *Buchan-ness* to *Weak*,
North-West by North.   18.

From *Buchan-ness* to *South-Ronald=*
shaw, and *Copman-shaw* in *Ork-*
ney, North=North=West.   21.

From

Leagues

From *Buchan-ness* to the *Fair-Isle*,
  North half Westerly.   34.

From *Fair-Isle* to Sumbrough-head,
  North North East.   7.

From *Sumbrough-head*, to the *Isle of Musa*; *North North East.*   4.

From *Musa* to *Brasse-head*, *North.*   3.

From the *Carr* to the *May*, *South.*   2.

From the *Carr* to *Elye-ness*, *South West by West.*   3.

From *Ely-ness* to *Kinghorn-ness*, *West South West.*   4.

From *May* to *Kinghorn-ness*, *West=South-West, quarter Westerly.*   7

From *May* to *St. Abbs-head*, *South-East*   6

From *St. Abbs-head*, to the *Scairs*, *South-East.*   6

From *Scair-heads* to *Tinmouth*, *South by East.*   15.

From *Scair-heads* to *Flambrugh-head*, *South South East half Easterly.*   39.

From *Tinmouth* to *Flambrough-head*, *South-East.*   25.

From *Flambrough-head* to the *Spurn*, *South by East.*   8.

From

Leagues

From *Flambrough-head* to the *Sheeld*, South East by South — 24.

From *Flambrough-head* to the *Bank of Limmer* and *Ore*, South-East by East — 28.

From *Cromer* to *Winterton*, South East by South. — 8.

From *Winterton* to *Yarmouth*, South by East. — 2. half

From the *Holms*, to *Orford-ness*, South by West. — 9.

From the *Holms*, to the *Downs*, South. — 25.

From the *Downs*, to the *Veergat*, East-North-East. — 21.

From the *Veergat*, to the *Maes* North-East. — 10.

From the *Maes*, to the *Tessell*, North North-East. — 22.

From the *Tessell*, to *Heligeland*, North-East by East. — 40.

From the *Tessell*, to 14 fathom on the *Iutish Riff*, North-North-East. — 72.

From *Heligeland*, to *Horns Riff*, North North-West. — 24.

From *Horns Riff* to 14 fathom on the *Iutish Riff*, North by East, — 20.

Ow

Over Seas.	Leagu:
From the *Fair-Isle*, to the *Stadeheads* in *Norway*, North-East half Easterly.	80.
From *Roen* and *Ornall*, to *Visheires*, South by East,	24.
From *Visheires* to the *Naze* South-East	34.
From the *Naze*, to the *Scaw*, East.	30.
From the *Scaw*, to the *Trindell*, South-East by East.	8.
From the *Trindel*, to the *Riff* of the *Annot*, South-East by South.	8.
From the *Riff of the Annot*, to the *Koll*, South-East by South nearest.	12.
From the *Koll*, to Elsenoor, South-East by South.	4.
From *Read-head*, to the *Naze*, East by North,	102.
From *Read-head*, to *Skut-ness*, East-North-East,	80.
From *Buchan-ness*, to *Stade-heads*; North-East by North,	100.
From *Buchan-ness*, to the *Naze*, East a third part South.	99.
From *Buchan-ness*, to the *Maes*, South-East by South a third part South.	130.

From

Over Seas.

Leagues

From *Fair-Isle*, to the *Maes*, South-South East,　163.

From the *Maes*, to the *Naze*, North by East,　110.

From *Aberdeen-ness*, to the *Naze*, East a third part *North*.　95.

From *Aberdeen-ness*, to the *Maes*, South-East by South,　121.

From the *Island of May*, to the *Naze*, E. by N. a third part *Northerly*.　103.

From the *Island of May*, to the *Skurness*, North-East by East.　85.

From without the *Island of May*, to the *Maes*, South East, a third part Southerly,　110.

From the *Island of May*, to *Heligeland*, East-north-east a third part *Easterly*.　120.

From *Flambrough-head*, to the *Naze of Norway*, North-East.　194.

From the *Holms of Yarmouth*, to the *Maes*, East-South-East half Southerly 28.

From the *Maes*, to the *Bank of Limet*, and *Ore*,　30.

CHAP. XX.
The Latitude of severall places, in the North-Seas.

	deg.	min.
Tay, and *Inch Cape*,	56.	
Middle of *Read-head*,	56.	
Tod-head,	56.	
Aberdeen-ness,	57.	
Buchan-ness,	57.	
Middle of the *Murray-Firth*,	58.	
Copeman-shaw,	58.	
Sumbrough-head,	60.	
Island of May,	56.	
St. *Abbs-head*,	56.	
Tinniouth Bar,	55.	
Flambrough-head,	54.	
Limer and Ore,	53.	
The *West end of the Dogger sand*,	54.	
The *Maes*,	52.	
Heligeland,	54.	
The *Naze*,	57.	
Skut-ness,	58.	
Ssade-heads the middle most,	62.	
Brasse-found,	60.	

CHAP. XXI.
Of the Sphear.

THe *Zenith* is a point in the Heavens, right over our heads, and the *Nadir* a point in the Heavens right opposite thereunto.

The *Horizon* is a great Circle 90 *degrees* distant from the *Zenith* and *Nadir*, which divides the World into two equall parts; the upper and visible *Hemisphear*, and the lower and invisible.

The *Poles* of the World, are two fixed points in the Heavens, Diametrically opposite to one another, the one visible in our *Hemisphear*, is called the *North* or *Artick Pole*, the other not seen of us, being in the lower *Hemisphear*, is called the *South* or *Antartick Pole*.

The *Equinoctiall* or *Equator*, is a great Circle 90 *degrees* distant from either *Pole*, dividing the World into two equall parts, called the *North* and *South Hemisphears*: the declination of all the Celestiall bodies, is their perpendicular distance from it, or an Arch of the *Meridian*, contained betwixt

O   the

the Center of the *Sun* or *Star*, and this Circle, and the right afcenfion of *Sun* or *Star*, is accounted on it, begining at *Aries* : the diftance betwixt the *Zenith* and this Circle is alwayes the *Latitude*, being the one thing fought for in all Obfervations.

The *Ecliptick* is a great Circle, croffing the *Equinoctiall* in the two oppofite points *Aries* and *Libra*, making an Angle therewith of 23 *degrees* 30 *minutes*.

The *Poles* of this Circle, lyeth from the *Poles* of the World, 23 *degrees* 30 *minutes*, according to the forefaid Angle made by this Circle, and the Equinoctiall.

The *Latitude* of the *Moon* and *Stars* is an Arch of a Circle, contained between their Centers, and this Ecliptick line : this Circle maketh right Angles with the *Ecliptick*, and is accounted either *North-ward*, or *South-ward*, according to their fituation.

This *Ecliptick* may be called the *Suns Rode-way Annually*.

The *Tropicks* are two fmaller Circles parallel to the *Equinoctiall*, one upon each fide thereof, being diftant from it 23 *degrees* 30 *minutes*, limiting the *Suns* greateft *Declination*.

The *Polar Circles* are two small Circles, parallel to the *Equinoctiall*, and distant therefrom 66 degrees 30 minuts, and from the *Poles* of the World, 23 degrees 30 minuts.

These things being premised, I come now to practice in Observation of *Sun* or *Star*, to attain the *Latitude* over all the Earth.

Now seeing that there is 90 degrees betwixt the *Equinoctiall* and either *Pole*, and also, alwayes 90 degrees betwixt the *Zenith* and the *Horizon*: *Argue* then, when the *Equinoctiall* hapneth to be in the *Zenith*, the *Poles* will be in the *Horizon*, and so consequently, when any of the *Poles* is in the *Zenith*, the *Equinoctiall* will be in the *Horizon*: It followeth then, that what ever the *Equinoctiall* be distant from the *Zenith*, the one *Pole* is as much above the *Horizon*, and the other as much below.

Example, If the *Equinoctiall* be found 30 degrees to the *South wards* of the *Zenith*, then is the *North-Pole* 30 degrees above the North part of the *Horizon*; and the *South Pole* 30 degrees below the *South*, and this is called *North Latitude* 30 degrees.

But

But if the *Equinoctial* had been 30 *degrees* to the *North-wards* of the *Zenith*, then had the *South Pole* been 30 *degrees* above the *South* part of the *Horizon*; and the *North Pole* 30 *degrees* below the *North-part*: and this is called *South-Latitude* 30 *degrees*.

Now it may be said, how shall the *Æquinoctials-distance* from the *Zenith*, or from the *Horizon*, be found? Seeing it is but an Imaginary *Circle*, drawen out by the Pinsil of mans Imagination, and is invisible to the Eye.

It is answered, although that Observation cannot be made of the *Equinoctiall*, (it being an Imaginary thing) yet it may be made of any of the *Cœlestiall Bodies* whose distance from it and the *Poles* is known, as the *Sun* or some of the fixed *Stars*, and then knowing their distance from it, (which is their *Declinations*) and so according as they are above or below the *Equinoctiall*, *Addition*, or *Substraction*, is made of the *Sun* or *Stars* Declination, to or from the *Complement* of their *Meridian-Altitude*, (or near their distance from the *Zenith* at *Noon*) and except so is found the *Equinoctials* distance from or to the *Zenith*, which is the *Latitude*. The

The same may be effected, by the *Meridian Altitude* of *Sun* or *Star*, considering as aforesaid, whether the *Sun* or *Star* be above or below the *Equinoctiall*: and so accordingly, to add or substract the *Sun* or *Stars Declination*, to, or from the *Meridian Altitude*, (or their hight at *Noon*) and that sume is the hight of the *Equinoctiall* or *Complement* of the *Latitude*.

Note, that in *North Latitude*, if either *Sun* or *Star* be to the *South* wards of the *Zenith*, and have *North Declination*, then are they above the *Equinoctiall*; and having *South Declination*, is below it, and so the contrary in *South Latitude*: for the *Sun* or *Star*, being to the *North* wards of the *Zenith*, and having *South-Declination*, is above the *Equinoctiall*, and having *North* is below it.

Likewise, the *Sun* or *Star* may be on the one side of the *Zenith*, and the *Equinoctiall* on the other, and this (as to the *Sun*) is within the *Tropicks*: or in places near the *Equinoctiall*, when the *Declination* exceeds the *Latitude*: In this case, the *Sun* or *Stars* distance from the *Zenith*, being

at the *Meridian*, is substracted from their *Declinations*; and the remainder is the *Latitude*; which shall be spoken to in due place.

Likewise, within the *Artick*, or *Antartick Circles*, if the *Suns Meridian Altitude* be observed below the *Pole*, then add the *Suns* distance from the *Pole* (which is the *Complement* of the *Suns Declination*) to the *Meridian Altitude*, and that sume is the *Poles-hight*, or *Latitude*.

If you observe the *Sun* or *Star* in the *Zenith*, then the *Declination* either *Northerly* or *Southerly*, is the *Latitude* of the place.

If the *Sun* or *Star* have no *Declination*, then the *Complement* of their *Meridian-Altitude* (or distance from the *Zenith* at *Noon*) is the *Latitude*, if they be on the *Meridian* In the *South*, the *Latitude* is *Northerly*, and if *North*, *Southerly*.

First Example, Admit you are at *Sea*, and the *Sun* being upon the *Meridian* in the *South* is 37 degrees 30 minuts, distant from the *Zenith*, at the same time hath 20 degrees 00 minuts *North Declination*, is demaunded the *Latitude*? *The*

The Operation.   deg. min.
Complement of the *Meridian*
   Altitude,   37.   30½
The *Suns Declination North*,
   being added,   20.   00.
The *Latitude* of the place, *North*.   57.   30.

Here you see, that the *Complement* of the *Meridian Altitude* (or the *Suns* distance from the *Zenith* at *Noon*) being added to the *Suns* distance from the *Equinoctiall*, (or the *Suns Declination*) that sume is the distance of the *Equinoctiall South wards* from the *Zenith*, or the *Latitude Northerly*, being 57 degrees 30 minuts.

A second Example, Admit, being at *Sea*, the *Sun* being on the *South-part* of the *Meridian*, 70 degrees 30 minuts distant from the *Zenith*, and the *Declination* 20 degrees 0 minuts *South*, is demaunded the *Latitude* of the place ?

   The Operation.   deg. min.
Complement of the *Meridian*
   Altitude,   70.   30.
The *Suns Declination South*,
   substracted,   20.   30.
Latitude of the place, *North*.   50.   00.

                                                          Here

Here you see, that the *Suns Declination* being substracted from the *Complement* of the *Meridian Altitude*; (or the *Suns distance* from the *Zenith* at *Noon*) and the remainder is 50 *degrees* 00 *minuts* the *Equinoctials* distance *South wards* from the *Zenith*, or the *Latitude Northerly*.

A third Example, Admit a ship at *sea* and the *Sun* upon the *south-part* of the *Meridian*, 10 *degrees* 00 *minuts* distant from the *Zenith*, the *Declination* being 20 *degrees* 00 *minuts South*, is demaunded the *Latitude* &c.

	deg.	min.
The Operation		
The Suns Declination Southerly	20.	00
The distance from the Zenith, or Complement of the Meridian Altitude,	10.	00
The Latitude South,	10.	00

Seeing the *Suns Declination* exceeds the *Complement* of the *Meridian Altitude*, therefore I substract the *Complement* of the *Meridian Altitude* from the *Suns Declination*, and there remains 10 *degrees* 00 *minuts*, the distance of the *Equinoctial North-wards* from the *Zenith*, or the *Latitude Southerly*.

A fourth Example, Suppose the *Suns Declination*

lination were 20 *degrees* 30 *minuts South,* and the *Sun*, upon the *North part* of the *Meridian*; distant from the *Zenith*, 35 *degrees* 30 *minuts*, is demaunded the *Latitude*?   *The Operation*   deg. min.

The *Complement* of the *Meridian*
  Altitude,   35. 30,
The *Suns declination South* added, 20. 30.
The *Latitude South*.   56. 00.

Here I add the *Suns Declination*, to his distance from the *Zenith* at *Noon*, and that *same* is the *Equinoctialls* distance *North-wards* from the *Zenith*, or the *Latitude Southerly*, being 56 degrees 00 *minuts*.

A fifth Example, Suppose the *Suns* distance from the *Zenith*, upon the *North part* of the *Meridian*, to be 38 *degrees* 20 *minuts*, having at that time, 10 *degrees* 10 *minuts North Declination*, is demaunded the *Latitude*?

          The Operation   deg. min.
The *Complement* of the *Meridian*
  Altitude,   38. 20.
The *Suns Declination North*
  substracted,   10. 10.
The *Latitude South*,   28. 10.

P   The

The *Suns Declination* being substracted
from the distance, from the *Zenith* at *Noon*
and there remains 28 *degrees* 10 *minuts*, being the *Equinoctials* distance *North-ward*
from the *Zenith*, or the *Latitude Southerly*.

A sixth Example, Suppose the *Suns Declination* were 20 *degrees North*, and the
Co-Altitude 13 *degrees* the *Sun* being upon
the *Meridian* in the *North*, is demaunded
the *Latitude* ?

The Operation	deg.	min.
The *Suns Declination Northerly*;	20	00
The *Co-Altitude*, or *Zeniths* distance;	13	00
The *Latitude* of the place, *North*.	7	00

Seeing the *Suns Declination* is greater then
the *Complement* of the *Meridian Altitude*
therefore, I substract the *Co-Altitude*, from
the *Suns Declination*, and there remains 7
degrees 00 *minuts*, the distance of the *Equinoctial South-wards* from the *Zenith*, or
the *Latitude Northerly*.

A seventh Example, Admit a Ship at
Sea, and the *Sun* being upon the *North part*
of the *Meridian*, below the *Pole*, his *Meridian Altitude* being 8 *degrees* 10 *minuts*, the
Suns Declination being that day 23 *deg.* 00 *mi.*

demaunded the *Latitude* ?

   The Operation.   deg min.

The *Meridian Alt* below the *Pole,*   8. 10.
The *Complement* of the *Declination,* 67. 00.
The *Elevation* of the *North Pole.*   75. 10.

 Here I add the *Suns* distance from the *Pole,* (or *Complement* of the *Declination*)to the *Meridian Alt* that sume is 75 degrees 10 minuts, the *Poles* hight, or *Latitude* of the place.

 This laſt *Queſtion* might have been reſolved, by the *Complement* of the *Meridian Altitude,* by adding the *Suns Declination* to the *Complement* of the *Altitude,* and ſubtract that ſume from 180 *degrees,* and the remainder is the *Elevation of the Pole.*

 If you would find the *Latitude* and *Suns Declination,* by the two *Meridian Altitudes* of the *Sun* in one day, then add the *Complements* of both *Meridian Altitudes* together; and half that ſume is the *Complement* of the *Suns Declination,* (or his diſtance from the *Pole*) the which being added to the *North Meridian Altitude* below the *Pole* and that ſume is the *Poles* hight or *Latitude.*

 For Example,   Admit there be one at ſea, who found the *Suns* diſtance from the

    P 2   *Zenith.*

Zenith, or *Complement* of the *Meridian Altitude*) being upon the *South-part* of the *Meridian*, to be 53 deggrees 10 minuts, and the fame day, being upon the *Meridian*, in the *North*, was 82 degrees 20 minuts diftant from the *Zenith*, is demaunded the *Latitude*, and *Suns Declination*?

The Operation	deg.	min.
The diftance from the *Zenith* upon the *Meridian* in the *South*,	53.	10.
The diftance from the *Zenith*, upon the *Meridian* in the *North*	82.	20.
The fume of both, is	135.	30.
The half fume being the *Complement* of the *Suns Declination*,	67-	45.
The *North Meridian Alt.* added,	7.	40.
The *Latitude North*.	75.	25.

The *Complement Altitude* of the *Sun*, at either part of the *Meridian* being added together, amounts to 135 degrees 30 minuts, the half of which, being 67 degrees 45 minuts, is the *Complement* of the *Suns Declination* (or his diftance from the *Pole*,) to which is added the *North Meridian Altitude* 7 degrees 40 minuts, gives 75 degrees 25 minuts for the *Elevation* of the *North-Pole*: fo

if you substract the *Suns* distance from the *Pole*, being 67 *degrees* 45 *minuts* from 90 *degrees*, the remainder will be 22 *degrees* 15 *minuts*, the *Suns* distance from the *Equinoctiall*, or his *Declination*.

What hath here been delivered in these Rules, concerning the *Suns* being upon the *Meridian* as to obtain the *Latitude*, the same is to be understood of any *Star*, whose *Declination* is known: As for working an Observation, by the *Meridian Altitude* of *Sun* or *Star*, I have touched it a little here before, I leave the rest to your own practice.

CHAP. XXII.
To know whether Sun or Star will rise or set in any Latitude.

IF you would know, whether the *Sun* or any *Star* will set or rise in any *Latitude*, take these following hints?

If in *North Latitude*, the *Suns Declination Northerly*, exceed the *Complement* thereof, then the *Sun* sets not at that time, in that *Latitude*. And so consequently, if the *Suns Declination Southerly*, exceed the *Complement* of the

the *Latitude*, then the *Sun* riseth not at that time in that place : Also, what ever the *Suns Declination Northerly*, exceeds the *Complement* of the *Latitude*, so much is the *North Meridian Altitude* below the *Pole* ; Lykewise what ever the *Suns Declination Southerly*, exceeds the *Complement* of the *Latitude*, so much is the *Sun* below the *South Horizon* at mid-day : the same is to be understood with the *Fixed Stars*, and if in *South Latitude*, the contrarie. Having premised these things, I come now to practise.

Let the *Latitude* be 74 *degrees* 00 *minuts* and the *Suns Declination Northerly*, 20 *degrees* 00 *minuts*, is demaunded the *Suns Meridian Altitude* below the *Pole* ? Here the *Suns Declination*, exceeds the *Complement* of the *Latitude* 4 *degress*, so *Argue*, the *Sun* will be 4 *degrees* high at the *North part* of the *Meridian* below the *Pole*. Lykwise, if the *Suns Declination* had been 20 *degrees Southerly* in the foresaid *Latitude*, then the *Sun* would be 4 *degrees* below the *South part* of the *Horizon* at mid-day.

The *Question* will be now, how long tyme the *Sun* continueth above the *Hori-*

zon in the foresaid *Latitude* and setteth not ?
and also, how long time the *Sun* continu-
eth below the *Horizon* and ryseth not ?

To resolve this *Question*, *First* consi-
der, what is the *Complement* of the *Latitude*,
which in this *Question* is 16 *degrees*; then
look into any ordinary *Callender*, or *Na-
vigation Book*, wherein is the *Tables* of the
the *Suns Declination*, and look what day
of the Moneth the *Suns Declination* (being
increasing *Northerly*) is 16 *degrees*, (or
near it,) and remark that day of the Mo-
neth, and then look again for the same *De-
clination*, when it is decreasing, and like-
wise, remark that day of the Moneth, *Argue*
then the *Sun* will not set in all the time be-
twixt the two aforesaid found dayes. Like-
wise, if you would know the time where-
in the *Sun* will not rise, then look into the
Tables of the *Suns Declination* and see what
day of the Moneth the *Suns Declination*
(being increasing *Southerly*) is 16 *degrees*,
(or near it) and remark that day of the
Moneth; then look again for the same
Declination, when it is decreasing, and
remark likewise that day of the Moneth,
Argue.

Argue then the *Sun* will not rife in all that time, betwixt the two aforefaid found days, which I fhall hold out in two Examples.

The *firft Example*, Admit the *Latitude* be 74 degrees 00 *minuts North* is demaunded how long time the *Sun* will continue above the *Horizon*, and not fet?

Firft, Look into the Tables of the *Suns Declination*, for 16 *degrees North Declination* increafing, (or near it) and you will find it, to be about the 24 day of *April*, which day the *Suns Declination* is equivalent to the *Complement* of the *Latitude*, and therefore cannot fet. Then look again for the fame *Declination Northerly*, being decreafing, and you will find it to be about the 29 day of *Iuly*: *Argue* then the *Sun* will not fet in all the time between the two aforefaid dayes, which is 96 dayes that the *Sun* continueth above the *Horizon* and feteth not.

The *fecond Example* Let the *Latitude* be the fame, is demaunded how long time the *Sun* will continue below the *Horizon* and not rife?

Firft, Look into the Tables of the *Suns Declination*

...the declination, for 16 degrees South Declina-
tion increasing, (or the nearest to it,) and
you will find it to be about the 26 day of
October, which day the *Suns Declination Sou-
therly* is equivalent to the *Complement* of
the *Latitude*, and therefore cannot rise.
Then look again for the same *Declination
Southerly* decreasing, and you will find it
to be about the 25 day of *Ianuary*. Now
consider the time betwixt the two dayes
aforesaid, and you will find it, to be 91
dayes that the *Sun* continueth below the
Horizon, and riseth not; so that in the *La-
titude* of 74 *degrees North*, the *Sun* seteth
not from the 24 day of *April* to the 29
day of *Iuly*: and also coontinueth below the
Horizon, and riseth not, from the 26 day
of *October*, untill the 25 day of *Ianuary*,
so that at the *Poles* there is but one day,
and one night, in all the Year.

Note, That when the *Sun* seteth not
within the *Artick Circle*, then he riseth not
within the *Antartick Circle*; so that, whilst
it is day at the one end of the Earth, it is
night at the other: And whilst it is *Sum-
mer* at the one end, it is *Winter* at the
other:

Q

other: And when the *Sun* riseth to
place, it setteth to their *Antipodes*,
that, when we rise to our Labours,
Antipodes goeth to rest, and when
sow, others do reap. O what Ioy i
to Contemplat the wonderfull works
the Almighty GOD! to whom be
ternall Praise, *Amen*,

❧❧❧❧❧❧❧❧❧❧❧❧❧❧

F I N I S.

❧❧❧❧❧❧❧❧❧❧❧❧❧❧

THE CAREFULL

Sea=Man,

Containing severall most necessary
Points, of the *Sea-Man's* Duty,
both at *Sea*, and on *Shore*.

TOGETHER,

With a Dialogue, betwixt a *Skip-*
per, and a *Sea-Man:* Contain-
ing his Duty, belonging to *Top,*
Yaird, Helm, and *Lead.* &c.

By the foresaid Author.

THE CAREFULL

Shepherd,

Containing several most necessary
Points, of the Sea-Man's Duty,
both at Sea, and on Shore.

TOGETHER,

With a Dialogue, betwixt a Ship-
per, and a Sea-Slave: Contain-
ing his Duty, belonging to Top,
Yard, Helm, and Lead, &c.

By the foresaid Author.

The Carefull-Seaman.

IT is the duty of every Sea-man, after he is once hyred, to wait carefully both Day and Night upon the *Ship*, in reference to the securing of her, whether in a *Road* or a *Harbour*; and to the take-ing in, and stowing the Merchands-Goods, and fitting the *Ship* to *Sea*, which three points, I intend to handle here particu-larely, as to the holding out a *Careful-Seamans* duty in either of them: and then to hint at some things, which concerns his du-ty at *Sea*; for, I will not take upon me to tell all, lest I should weind my self in a laborynth of discourse, and so should hard-ly be able to get out again.

First then, for securing the *Ship* in a *Road.*

In the first place, consider what manner of *Road* it is, and then advise, which is the safest way to Moare in it; for which

I shall for Method sake, propone three
sorts of *Roads*.

The first, let be a *Bay* having the *Sea* o-
pen, where is no *Tyd-way* : Suppose the
second be a large *River*, or any other bounds
upon the *Sea-coast*, where is the *Tyd-way*
of *Flood* and *Ebb* ; and let the third be a
narrow *River* : which three, I shall touch
at particularly, in showing the feasablest
way to Moare the *Ship* in either of them.

For the first, it is fit, that there be one
Anchor to the *Sea*, (and that the best of
the two) and the other towards the *Shore*.
For the second, it is best to Moare as the
Tyde runs, one *Anchor* for the *Flood*, and the
other for the *Ebb*, the best of the two
being alwayes out towards that Art, where
is farthest to the *Weather Shoar*. For the
third, (being a narrow *River*) the safest
way, is to Moare cross the *River*, so, that
the *Ship* ryds betwixt two, either *Flood* or
Ebb.

Note, That our ordinare *Ships* about an
hundred Tones, hath commonly four An-
chors, which are thus named, *Best-anchor*,
Best-Bowar, *small Bowar*, and *Kadge* : com-
monly

monly (though a thing indifferent) the best *Anchor* lyes on the *Star-boord bow*, and the *smal-Bowar-Anchor* before it; and the *best Bowar-Anchor* on the *Lee-boord side*, and *Kadge-Anchor* be-aft it; and ordinarly, the *Ship* is Moared with the *best Bowar* and *small-Bowar-Anchors*, having alwayes the *best-Anchor* in readinefs, as a reserve, from what may fall out.

Have a speciall care in Moaring the *Ship*, that your *Anchors* fall clear, so that the *Cables* be no wayes foul of the *Armes* and *Stocks* of them; and that the *Bouy-Ropes* be clear of the *Cables*.

Of Cloathing or Serving the Cables.

The *Ship* being now Moared, the next duty of the able *Sea-man*, is to Cloath or Serve the *Cables*, first in the *Hafs*, and all along the *Bows*; this cloathing (or service) is of length more or less, according to the greatness of the *ship*, which must be of a good thickness in the *Hafs*, (or *Grip*,) and especially where the *Cables* ly cross the *Steven*. It is his duty also, to try and search, if there be any foul

ground

ground betwixt the *Ship* and the *Anchors*, for, if there be, the *Cables* may incurr great damnage, and may also indanger Lives, *Ship* and all. The best way to help this, is to bouy up the *Cables* with empty *Cask*, as near the *Anchors* as you can conveniently; and once in the two dayes (or every day as occasion serves) to underrun them, and see how they are : Likewise, he ought to have the other part of the *Cables*, that are within boord, alwayes in a readiness to veer out.

Of a carefull Sea-man's attendance in a Road.

A Carefull *Sea-man* ought alwayes to keep the *Hass* clear, for if the *Cables* be twisted before the *Steven*, then you can neither veer out, nor take in, which is a great inconveniencie.

Also, he ought not to leave the *Ship* in a *Road*, without there be so many men left in the *Ship*, as to let the best *Anchor* fall.

A *Sea-man* ought not to leave the *Ballast-Port* open, whither in a *Road*, or any *Harbour*.

It is likewife the duty of a Carefull Sea-man, to look after the winding, or turning about of the *Ship*, whether it be with the *Wind* or *Tyde*, that the *Ship* do not girt, or be caught in the bought of her *Cables*: for it is much to *Anchors* to hold, when the *Ships* broad-fide lyes either to *Wind* or *Tyde*.

It is alfo his duty evening and morning, (or oftner if need require,) to try the *Pump*, for *Ship-fides* are fubject to giffen; and may get thrufts and blowes, and may happen to ly on the tops of old-pales, and many other fuch like inconveniencies may befall her, when (may be) none of the *Ship* expects it. For inftance, two of our own Countrey-men, the one at the *Bridges of Konnings-berg*, in *Auguft*, *Anno* 1676, where the water was above the lower Tyre of Packs, before any man did know of it. The fecond was in *Dantzick-Road* in *Iune*, *Anno* 1677, where happened to be the fame: many other things might be fpoken, as to the attendance of a *Ship* in a *Road*, but I leave it to your own practice.

R
of

Of a Carefull Sea-mans *duty, in a* Haven *or* Harbour.

In the first place, he ought to Moare the Ship well upon three or four Towes, as his Iudgement shall think fit, which Towes ought all to be well cloathed (or serv... ed) upon all places where they bear either upon the *Ship,* or on the *Shore;* commonly such cloathing or service, are piec... of *Canvass,* or some other such like thing: and is laid on tight and neat upon the Tow, well made fast with knittell... and rop-yarnes, the reason why I speak so much of this, is, because some of our *green-horne-Sea-men* thinks it but a thing indifferent, and some times over looks it, but those that have been oft at *Scairs-burgh* can tell you, that this piece of work may be ranked amongst the best about the *Ship,* for the ommitting of this duty some-tymes there, may indanger *Ship* and *Lad...*

The *Ship* being now Moared, the next thing is to fender well on both sides, if necessity do so require; but beware of hanging

...nging over boord round buoys, or ...ch like pieces of wood, (as many are ...pt to do,) for if such happen to bear be...ixt two Timbers, it may do skaith, but ...e onely best Fenders, are severall coills ...old ropes in one bundell, lykewise ...unches of hoops are good, and if you ...ake a Fender of any peece of Tree, let ...ly sloping alongst the *Ship* side, that it ...ay bear upon the moar-Timbers.

It is also the duty of the Carefull *Sea-man*, that if the *Ship* be empty (or light) ...beware how she lyeth betwixt two load...ed *Ships*: if in a dry *Harbour*, keep them ...oth at a distance off? that your *Ship* ...may have room to take the ground, for *Ships* ...re alwayes two or three foot broader at ...he barkets, (or bindes) then they are ...our or five foot below them; If in a *Road*, ...ep at a distance, or fender well.

A Carefull *Sea-man* ought also to lay (or make fast) the *Boat* in a convenient ...place, that she be not indangered to be ...broken betwixt *Ships*, nor under-...ing ...nd to have alwayes her *Bars* and *Tholls* in ...readiness.

A _Sea-man_ ought alfo (whether in
Road, or dry _Harbour_) to be carefull that
all Casks, and others, that may happen
to be in the _Howld_, or betwixt _Decks_, or
any other where; that they be well coin-
ed and made faft in the place where they
are; that they roll not over, the flothing
of this duty, may fome times bring the
bung of a Cask where the bottom was
and both it, and other things, may be in
hazard of being broken.

He ought to try the Pump every _Tyde_
at her ryfing a-float, and a little time be-
fore fhe take the ground. Now having
fpoken a little, as to a prudent _Seaman_, in
his attendance on the _Ship_, being in a _Road_,
and in a _Harbour_, it will follow to treat of
thefe things that concerns him, in fitting
and right ordering the _Ship_, for the intaking
the _Merchants-Goods_, and S towing of them.

Of fitting the Ship _for in-taking the_
Merchands-Goods.

In the firft place, it is his duty to notice
the _Takles_, that they be good, efpecially,
the Straps of the _Blocks_ and _Hooks_, thers-
A   after

after to hang those *Takles* right over the *Mid-Ship-Doors*, or over any other Doore, where the Goods are most conveniently taken in, for which end, the *Main-Yard* is commonly taken in A-long-Ships, and the *Taikle* made fast thereto as aforesaid: Or, a *Rop* past from the heads of both *Masts*, and the *Takle* made fast in the bought thereof. Likewise, he is to have in readiness sufficient *Slinges* and *Can-Hookes*, the which the Goods are to be taken in with, also it were well done of the *Carefull Sea-man* (before any Goods goe aboord,) to lift all the *Durt-Broods*, (or *Limber Boords*,) and to clear all the *Limber Holles*, that the water may have free passage to the *Pump*: and also, to make clean betwixt the *Floor-Bands*, taking away all *Durt*, or *Chips*, and such like things, as may Chock the *Pump*.

The next thing, is, to fit and prepare the *Ships-howld* for the quality of Goods to be taken in, and then to the Stowing of them; the which for brevities sake, and to keep Method, I shall treat of the severall Cargoes of Goods, under the Notion of Six Severall Qualities: To wit,

First

First, *Cornes*, *Seeds* and *Salt* by the bulk.

Secondly, *Pack-Goods*.

Thirdly, *Liquours*, and *Pickled Herrings*, *Salmond*, and such like.

Fourthly, Of severall sorts of Merchand. Goods, as *Casks*, *Packs*, *Boxes*, *Baskets*, and many other such-like : both of diverse quantities and qualities.

Fifthly, Of *Iron*, *Lead*, and such-like things of great weight.

Lastly, Of *Trees*, *Planks*, and such-like.

Although these be but a few, of the severall parcells of Goods transported in *Ships*, notwithstanding the *Reader*, when informed of fiting and ordering the *Ships-Howld*, for the severall Parcells and Pieces of Goods foresaid, and the stowing of them; he may learne by Consequence, the ordering of other such-like.

Of *Cornes*, *Seeds*, and *Salt* by the Bulk.

If the Loadning be of *Cornes*, or *Seeds*, then the fiting and ordering the *Ships-Howld*, is the maine businesse: for these Goods stoweth of themselves.

The fiting and ordering the *Ships-Howld*,

will

will be in four severall pieces of work.

First, consider if your *Ship* will require most *Charge*, (or *Kiltage*,) and accordingly, more or less to provide it; and lay it neatly upon the Bottom, *Secondly*, to fit your *Bug-dellen*, which is a mean to preserve the Goods from *Bilge-Water*: this *Bug-dellen* is of hight from the Bottom more or less, according to the bignels and condition of the *Ship*; ordinarly, some part, or all the *Kiltage*, is put under it. *Thirdly*, you are to make the *Ship* as closs and tight in the *Howld* as possibly you can, the slighting of this duty, hath many times endangered all. *Lastly*, to fix your *Stellings Fore* and *Aft*, one upon each side, a like distance from the middle, four or five foot betwixt them, are commonly four or five Deall depth, more or less, according to the bignels of the *Ship*; be sure to fill up betwixt the *Balks*.

If your Loadning be of severall sorts of *Corns* and *Seeds*, then you must make *Bulk-Heads* cross the *Ship*, in manner of a partition-wall, to keep the one *Grain* from the other.

Ie

It is ordinary ; to lay the weightiest _Grain_ after in the _Ship._

Likewise, it is neceſſarie to cloath all the _Bowes_ and ſides of the _Ship_ with Bennells, or Matts of Strae; for the better preſervation of the Goods.

If the Loadning be _Salt_, then all the Proviſion is, a _Bog-dellen_ as aforeſaid.

The _Carefull Sea-Man_ ought alſo to keep the _Ship_ alwayes by the _Stern_ while ſhe is Loadning; for, when it is feaſably intended, that thus, and thus, Goods are to ly before the _Maſt_, and ſuch and ſuch Goods Be-Aft it, in the mean while, the Goods that are to ly before the _Maſt_ comes thronging in, and the Goods that are ordained to ly After in the _Ship_ comes not, by ſuch means, the _Ship_ may be brought by the _Head_, ſo that the _Pump_ can help little or nothing, and the Goods before the _Maſt_ may be in danger of _under-water._ I had Experience of this, in _April Anno_ 1668. in the _Road of Lisbon_, where was a Room kept in the _Ship_ Be-aft the _Pump_ for _Salt_, in the mean while, the other part of the Loadning (being _Suggar_) came

...me thronging in, so that the *Ship* was ...rought by the head for two dayes, in which ...me, by under-water, was dammage of ...0000 pound of *Suggar*, which cost me ...name of dammage as a *Sea-man* three ...und sterling. This Inconveniencie ought ...lso to be shuned in livering the *Ship*, so ...hat, whether Loadning or Livering, the ...hip ought alwayes to be kept by the *Stern*.

Of Pack-Goods.

The fiting, or ordering the *Ships-Howld*, for this Loadning, is in two severall pieces of work.

First, to provide most *Charge* (or *Kilorage*,) if the *Ship* so require, but whether ...he require it or not, there is a necessity for something to ly betwixt the *Ships-bottom* and the *Packs*, about five or six inches ...thick, more or less, according to the bigness and condition of the *Ship*.

Secondly, to lyne (or cover) the *Ships-sides* with pieces of thin *Plankes*, or Barrell *Staves*, or such-like, to keep the *Packs* from touching of them. These that Loaden *Flax* and *Hemp* within the *Sound*, or dinarly

S

narly lines all their *Ships-sides* Fore and aft, with thin *Planks*, making alwayes the upper edge of the low-most *Plank*, lap over the low-most edge of the other; which causeth the drop to the *Ship-side*.

If your Loading be *Flax* or *Hemp*, you must provide a *Winding-Takle*, or two or three paire of *Skrewes*. To treat of the stowing of these Goods would be but tedious, for experience in this, (as in all other things,) is the best teacher; notwithstanding, I shall hint at two or three points of this work, which may give some insight to the rest. Know, that ordinarly the greatest *Packs* ly betwixt the *Main-Mast* and the *Pump*, (understand here these that have the *Pump* a great way Be-*Aft* the *Main-Mast*) for there the *Ship* is commonly deepest, the small *Packs* *Before* the and Be-*Aft* in the *Peik*; and all along the *Ships-sides*. Your stowing also begins alwayes at the *Ships sides*, every *Pack* at the end of another, leaving alwayes the stouage to be in the middle of the *Ship*.

Of Liquors.

The stowing and ordering the *Ships-Hould*

for this _Cargo_, is but little, save only the
providing of _Killage_, if she require it; and
for the stowing of these Goods, ob-
serve these four points. _First_, lay all the
greatest _Casks_ upon the _Ships bottom_, re-
serving the smallest _Casks_ to is above them,
and to be put in places where others can-
not go. The _Second_ is, to stow every _Cask_
very right up. The _Third_ point, is to
coyn well, that they fetch no way at sea.
The _Fourth_ is, to remark that every _Cask_
be tight when it cometh in, and, if it be
found leaking, to set it by, and acquaint
the _Skipper_ and _Merchant_ of it. If the
Loadning be _Pickled Herrings_, _Salmond_, or
such like, then the stowing of them is
much like the other, only some _Bulged_
Casks, where the _Bilge_ of one _Cask_ is
ordered to try st with the ends of two other,
which maketh neat stowage.

Of severall sorts of Merchant-Goods.

All that is to be spoken here of siting
the _Ships Howld_, is to provide _Killage_ if
the _ship_ require it; which _Killage_ may be
stowed amongst the Goods at the bottom,

and

and so hinder no Lastage.

In stowing of such Parcells of Goods consider these things following : *First*, all great *Casks* of *Liquor*, and other *Casks* of Goods, weighty as *Liquor*, are all to be set upon the bottom of the *Ship*. The other *Casks* of a second size to ly above them, or upon the bottom, it there be room : The *Packs* and *Fardells* in a Tyre cross the *Ship*, above the foresaid *Casks*, as also, the slender *Dry-Ware-Casks*, *Boxes*, and *Bags*, in a Tyre together. The *Baskets*, *slender-Boxes*, *Kinkins*, and *Eighten-dales*, to ly here and there in places where they may not be indangered by any weighty thing; and as I said before, seeing most *Ships* requyreth to be deepest by the *Stern*, it will be necessarie that all the weightiest Goods ly *Be-Aft* the *Mast*.

A prudent *Sea-man*, ought not to stow any *Cask* of Goods, that is subject to dammage by water, (though great and weighty,) near the *Bildge* of the *Ship*. Likewise, he ought not to lay any *Pack*, *Fardell*, or, *Bag* of *Dry-Ware-Goods* near the *Ships-side*, except there be something be-twixt

...twixt as aforesaid, with the Loadning of *Pack-Goods*. Also, if such Goods be laid above *Casks of Liquor?* he ought to lay pieces of *Booras*, or such like, betwixt the *Bongs* of the *Casks* and them. Neither ought he to lay any slender *Box*, *Basket*, or such like thing, betwixt two *Casks* of bulk and weight. It is also a *Sea-man's* wisdom to keep out from under the *Doores* when the *Tables* are using, either at the Loadning or Livering of the *Ship*.

And *Lastly*, a *Sea-man* ought not to rummage the *Howld*, and turne over the *Merchants-Goods* with a *Candle* being alone, neither ought he at any time to stick the *Candle* upon the *Ships-side*, or upon any *Cask* or *Box*, (as many are apt to doe;) for in so doing, he may indanger *Ship* & all.

A sad Example I did see of this in *Elsenoor-Road*, in *August Anno* 1677: for a *Countrey-Man* of Ours, being loadned with *Iron*, *Tar*, *Flax* and *Hemp*; the *Master* with some more of the *Company* being *A-shore*, about the necessary business of the *Ship*, there being but one Man and a Boy *A-boord*, which went down in the *Howld* with a lighted

led *Candle*,) for some particular end, being somewhere about the *Pump* (it was said) did let the *Candle* fall, how-ever the *Ships-Howld* was set on fire, and many going *A-boord* (before the flame had broke out upon the *Deck*,) did cut the *Cable*, and run the *Ship A-shore*; In doing, standing, there was but little of either *Ship* or *Goods* saved. *Oh! what unthought of inconveniencies may the Womb of one day bring forth?*

Of Iron, Lead, or *such-like*.

As for fiting the *Ships-Howld* for all Loadning, know, that it is an old practice at *Stock-Hollem*, (where much *Iron* is brought from,) to hight the *Ship* in the *Howld* two or three foot with *Deals* and *Wood*, and then to lay the *Iron* above that; many by Experience can tell, that this way in loadning the Loadning, strains not the Ship so much, as when the Loadning lyeth directly upon the Bottom, and it will hold so in reason, for, when the Loadning lyeth low upon the Bottom, so that the Surface of the Water without, will be some

cime

some four or five foot above the top of
the Loadning within, now this *Ship* com-
ing to slinger at *Sea*, whilst the swell of
the *Sea* casteth Her to one hand, the great
weight below, brings Her quickly back
again, and being once set in motion, she
indureth at it, for a long *Pendulum* keeps
longer time in swinging to and froe, then
doeth a shorter one. Some is of the minde,
that if the top of the Loadning within
board (be two foot or thereby below the
surface of the *Water* without, it is enough,
for which end, they not only raise the *Iron*
as aforesaid, but at every nyne or ten *Last*
(more or less,) they cover the *Iron* with
Dealls; and this not only highes the *Iron*
but binds it. A Loadning of *Lead*, or such
like, may be stowed the same way. The
Loadning being in, then you are to lay *Balks*
above it, for keeping of it fast, three or four
or more *Be-Aft the Mast*, and as many *Before*
these *Balks* must be cut exactly in length,
according to the breadth of the *Ship* at the
top of the Loadning, and well noged at each
end, with large nogs to the *Ships-side*. A
man would hardly believe what work such
[sensib]

a Loadning will make, when the *Ship* comes
two or three dayes to ly under a *Main-sail* or
Mizon.

Of Trees *and* Planks.

All the preparation of the *Howld*, is to
provide *Kiltage*, (if the *Ship* require it,) the
which may be stowed at or near the bottome
amongst the Goods, & so hinder no Lastage.
The main point in stowing these Goods,
(whether *Planks*, *Trees*, or *Deals*,) is to
lay them all paralel to the *Keel*, I leave the
rest to your own practice.

Now having hinted at severall pieces of
Duty, which concerns a *Sea-man* in the se-
verall works foresaid, it will follow, that
we speak something, as to his duty in fit-
ing the *Ship* to *Sea*.

Of fiting the Ship *to* Sea.

A *Carefull Sea-man*, ought to imploy
all the intervalls of time, whilst a Load-
ning, in Rigging and fiting the *Ship* to *Sea*,
so that he, and the rest of the Company,
(at the time foresaid,) be so imployed,
in *Splysing*, *Bending*, *Serving*, *Marling*, and
                                          scraping

...riping *Masts* and *Blocks* : in short, to ...ook to the *standing* and *running-Rigging,* ...aps of *Blocks* , *Parlings* , that all be good; ...nd as every mans hand is in the *Dish,* so ...it be in the *Work.* It is better to say at ...that it is good that we did thus & the ...her, then to say, I wish we had done thus. ...It followeth now , that we speak a little ...to *Seamans-Duty* at *Sea*, which I shall ...old out here, in a *Dialogue,* betwixt a *Skip-* ...and his intended *Seaman*; in hinting ...some *points of his Duty*, belonging to ...p, or *Yard* , *Helm* , and *Lead.*

Skip. Good-morrow Young-man , I ...ve remarked you these two or three dayes ...bout this place , and I perceive you are a ...Seaman

Sea. *It hath been my Calling from my Youth.*

Skip. May I be bold to ask you where ...you live ?

Sea. *No boldness Sir , I live in Kirkaldy.*

Skip. There are as able *Seamen* there, ...in all *Fiffe.*

Sea. *It is even with us , as with other ...places , some good , some bad.*

Skip. Are you hyred with any Man, or

T

...d to go any Voyage?

Sea. No, I am at present free to acce...
...f a Voyage from you, or any other honest-m...
...hat will imploy me.

Ship. I doe want two or three me...
...yet, and could have them when I would...
but the truth is, that since the *Caping-ti...*
in our *Land*, we that are *Shippers*, are sadl...
beguiled with some, (we call *Capen-b...*
Seamen :) so that, we had great need...
know him well whom we hyre; for I mu...
speak it with regrate, there is some of th...
that knows no more of the *Sea*, then a *Sh...*
herd; and others, that are indeed able se...
men, but are scarce Morall; as being give...
to, *Loose-Handedness*, *Cursing*, *Smearing*...
Drunkenness, *Whoredome*, *Haughtyness*, and...
Strife; yea, and many other such *Vices*, which...
is the cause sometimes, that all these come...
not home with us, that goeth out.

Sea. It is most true, all that you say, fo...
I have sailed with some, that upon the Shore...
any would have thought them able Seamen, bu...
coming to Sea, were scarcely worthy of the Hat...
ches to ly upon; and whereas you speak of some...
to be Loose-Handed, I have (to pass by other...
thing...

things,) seen Seamen go as boldly to the Mer-
chants-Liquor as it were their own, with that
word in their mouth, We are not to carrie
Poison thorow the Sea: and to bear some Cur-
sing and Swearing; would make a Mans Hair
stand over end. Others there are, that are
given to Drunkenness and Whoredome, that
what they gain sometimes in three or foure Mo-
neths, with great Labour and Toyl, they will
frankly spend it in three or foure dayes time on
New-Wine and Strange-Women. Some 1
are so Haughty, and given to Strife, that
there is no living with them if you say not as
they say; and if either Skipper or Merchant
shall reprove them, (tho deserving,) then there
is nothing with them, but they'l go A-shore,
and if they can get but a Rope-Yairn, they'l
make a Cable of it, and bring the Skipper to
chargeable Law-sutes; but what shall I say,
that Compass which pointeth out the Courses of
their Life and Conversation, was never touched
with the Lord-stone of the Gospell.

    Skip. Truly you speak well, be your
Life and Conversation what it will, but O!
what miserable Condition is some of them
trysted with at the Long-run? few of their

repareth

repareth the decayed *Lands.*

Sea. *Ay*, but thay build a great many
Castles *in the* Air.

Ship. You are a very merry man I per-
ceive, I had rather have you to one of my
Company, (if you be the man I thinke you
are,) then those that would serve me a great
dale cheaper; and if you and I can agree,
you shall be welcome to a part of my *Voyage.*

Sea. *I thank you Sir, I am much obliedged
to you for your good Commendation.*

Ship. Might I without offence question
you of some points of a *Seamans-Duty*, and
to *Top*, or *Yard*, *Helm* and *Lead* ?

Sea. *Very freely Sir, for I have ever
been willing to Learn.*

Ship. In the first place, show me some-
things of a *Seamans-Duty* at *Top* and *Yard*,
as in loosing the *Sails*, and furling them.

Sea *In loosing the* Top-*Sailes*, at his
first coming in to the Top, he is to loose the
Bowline-Bridles, and Cloves of the Sail,
and secondly, the Yards-Armes, (making the
Gaskits all fast on the foreside of the Yard,)
and lastly, the body of the Sail, and so heave
it out. And in loosing the Low-Sails, he is

begin at the Yards-Armes, and loose all
towards the Bilge, leaving alwayes the Bow-
line-Bridles without the Cloves of the Sail.

Ship. Which be the causes of the *ships-
steering*, or answering the *Rudder*.

Sea. The first, is her way, (or *motion*)
thorow the *Water*, or, the *swiftness of the
Water After-out*: a second is the Sails, for
the *Aft-most Sails*, (to wit, Main-Sail, Main-
Top Sail and Mizon,) *brings Her to the*
Wind, and the Head-Sails (to wit, Fore-
Sail, Fore-Top-Sail, and Sprit-Sail,) *keeps
her from it.*

Ship. It would seem by your Answere,
that if a *ship* have no way thorow the Wa-
ter, she cannot answere the *Rudder.*

Sea. *Excuse me Sir*, a ship *may have no
way thorow the Water*, and yet may answere
the Rudder; *as with* ships *riding at Anchor
in a Current or Tyde-way*, by swift motion of
the Water After-out, they will answere the Rud-
der, as if they had way or motion foreward under
Sail: but sure I am, that if the Water be still
at the ships side, the Rudder then is of no use.

Ship. Show me something of your know-
ledge, as in steering the *ship* close by the

Wind, and upon a point of the *Compass* :

   Sea. *In steering the* ship *by the Wind,*
we are to have an Eye alwayes to the Main
Thaine ; and to the Weather-Sail, keeping
alwayes the Wind *about half a point on the*
After-side thereof ; if in a closs *Steerage,*
if it be darke-Night ; we have then ordered
one of the Watch *to tell* ino, *and remain*
the same by the Compass. *If to steer the*
upon a point of the Compass, *and it be an*
open-Steerage, (*where we can behold the mo-*
tion *of the* ships-head,) *we are to have a*
good Eye *Fore-out, and now and then to the*
Compass ; *a good Eye I say, in perceiving*
(*by the* Celestiall-Bodies, *the Sky, or the*
Water,) *the swift motion of the ships-head*
to this hand, or that ; and accordingly, to pre-
vent Her with the Helm : *but if it be in a*
closs-Steerage *there is no help, but a good*
Eye *alwayes to the* Compass, *and a good Ear*
to the Man that Conds.

   Ship. What be the marks of the *Hand-*
Lead-Line, and how used ?

   Sea. *The* Hand-Lead-Line, (*which or-*
dinarly is twenty fathom,) is marked with
five Marks, to wit, the Third, the Tenth,

and fifteenth Fathoms, marked with Leather, the fifth and seventh is marked with Red and blew Cloath: our place (or Station) in using the Lead, is always in the Weather-side ordinarly in the Main-Chains with a Breast rope, and in casting it out, we are always to keep a Taught line.

Ship. What be the marks of a Sounding-Lyne, and how is it used?

Sea. The Sounding-Line, (which is ordinarly an hundreth Fathom long,) is marked at every ten Fathom, (by a peece of Sailing-twyne set into it) with a Knot, to wit, in ten Fathom there is one Knot, at twenty Fathom there are two Knots, at thirty Fathom there are three Knots, and so consequently of the rest; and into the midst betwixt every ten Marks foresaid, there is a small Knot, signifying five. In using this Lead, as to Sounding in deep Water at Sea, if the ship by the Wind, (after the Lead is conveyed amongst the Weather-side to the Cat-head, bring the Fore-sail upon the Mast, and while before the ship hath lost her End way, cast out the Lead, with the ordinary word Watch. If the ship be Before the Wind,

then

then the Lead is convoyed (as aforesaid)
along the side, which will be the Weather-
most when brought by the Lee; if deep wa-
ter and stormy-weather, then the Lead is
convoyed as aforesaid, and also round the Ste-
ven, and is cast out as far as possible un-
the Lee-Bow.

Ship. You have answered pretty
to all these things; I will only ask you
Question or two more, and I have done
that is, show me the way how an old
Sea-man goeth to worke in waying the
in any *Roady*, and his Duty also at his
going out to *Sea*.

Sea. If it be in a Road where there is
Roomes both sides, and A-stern, it is
no great matter which way the ship be
but if it be in a Road, where is but little
then there will be a necessity sometimes to
the ship to such a band, as the judgement
the experienced Seaman shall direct him: whi
I shall show you by one Example:

Suppose a ship be at Anchor in a Bay,
Creek, (where there is no Current or Tide
way,) with the Wind right in Head,
shore and shald water being all pretty near

Ler-boord-side, and A-stern, and the
... on sterboord, now when the ship is
... Way to go to Sea, there is a necessity she
cast to sterboord, which is done thus, In
... time the Cable is Heaving (or Winding)
... make loose the Head-sailes, (to wit, the
Fore-sail, and Fore-Top-sail,) and Brace
... in A-Lerboord, and hail out the ster-
boord bowline of both; then loose the Main-
Top-sail and Mizon; and Brace in the Main-
yard and Main-Top-sail-yard A-sterboord:
if fair Weather, hoyse both Top-sailes up,
but if it be any Hach of Wind, let them re-
main at the Cape, lest the Anchor leap too
...,) and put the Helm A-sterboord.
Thus the ship will be in a capacity to cast to
sterboord, when the Anchor is from the
ground, and the ship cast aright; then hoyse
the Main-Top-sail, and hail out the Mizen:
the Main-Top-sail being full, fill the Fore-
sail, and Fore-Top-sail, A-boord the Fore-
tack, hail aft the Fore-sheet, hoyse the Fore-
Top-sail, (and when the Anchor is at the
Bow, if she require it,) loose the Main-sail
and set it; and so Steer out. The ship then
coming to fair Sea-room, the next Duty of
the

there while Sea-man will be thus; (first to have
will the Tarred-sails upon the Dedras, to furl
these before the Mast; then take in the
and secure her in her propper place) to the
the Anchors, and strike them upon the Bow
first the shrowds Fore and Aft, below,
above; dlailb the Fore-shrowds in the
of the Anchors) Well and make fast all the
Casks and others, that may happen to the
under Decks, above Deck, or any other

These be a few of the severall pieces of
belonging to the Able-Sea-man, as his
out to Sea) but I remember of four thin
that my Master once gave me by way of Ad

The First is, That if the *ship* be go
in, or coming out in any *River*, (or
other *Lead Man's* way) with a *Pilots A*
to put an able man to the *Helm*, and no
ignorant Boy, (as many are apt to doe)
for if any inconveniencie should happ
of the *ship* coming on the Ground, the
may pretend, that it was thorow default
that One at the *Helm*, who did not as
ordered him.

The Second is, That if turning at any
(especially in the *Night*,) in a narrow

Service, (or such like place) in company with other ships, that if any ship be *A-stern*, or be little over the *Weathers Quarter*, to call to them, or shew them a *Signe*, as to acquaint them before we stay.

Thirdly ; If sounding any time at *Sea*, (especially in the *Night* ;) we ought to looke well out, especially to the *Weather*, *Head* and *A-stern*, for the ship at that time, is not in a capacity to go out of the way of any other, that may happen to come sailing along.

The Fourth and Last is, When at *Sea*, not to suffer the one half Watch to go from the *Deck*, till the other be above ; and if any time, there be a man appointed to looke out, he ought not to come from his place ; till another relieve him.

F I N I S.

(or such like place,) in company with
... Ships, that in any Harbour, Road, Bay, or
... whatever the Weather permits, to look
... them, or if they think it dangerous to
... ship them before it be day.

... Wind's still sounding, and fine Weather,
especially in the Night;) we ought to
... look well out, especially to the Weather-
Head and Quarters. For the Ship that is
... is not in a capacity to go a-head, and
... of any other, that may happen to
... come sailing along.

... the Pump, and Lead: When at Sea,
... to suffer the one half Watch to go to a-
... Deck, till the other be above; and if
... any time, there be a man approaches to
... be out, he ought not to come from his
... ... till another relieve him.

＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊

F I N I S.

＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊

V
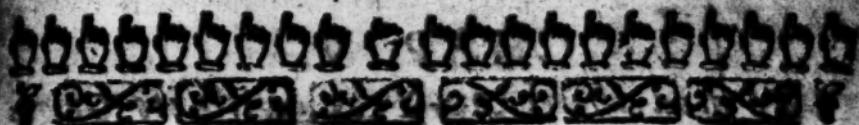
The Chief CONTENTS of this TREATISE.

CHAPTER I.
The Division of the Mariners Compass, and the reason of the Name of each Point.

CHAP. II.
The Thirtytwo Points of the Compass, reduced to twentyfour Houres, as necessary to find the hour of the Day or Night, by the Sun, Moon, or Starrs; and the Error of the Vulgar Opinion in it holden out.

CHAP. III.
To find the Golden-Number, with its Originall and use.

CHAP. IV.
To find the Epact, with its Originall and use.

CHAP.

CHAP.

CHAP. XI.

How to find the hour of the Night by the shaddow of the Moon, upon a Sun-Dyall.

CHAP. XII.

How to find the Hour of the Night, by Orions Girdle, vulgarly called the Ladies-Elwand: from September to March.

CHAP. XIII.

To reckon the Tydes in all places, knowing the Flowings.

CHAP. XIV.

How to find the variation of the Compass, and how it varieth, and how to rectify for the variation.

CHAP. XV.

The use of the Plac or Plain Chart.

CHAP. XVI.

How to find the Latitude the Ship is in, by Observation: showing the way of a forward and backward Observation by a Forstaffe, to obtain the Sun or Stars Meridian Altitude

CHAP.

FINIS.

Courteous Reader,

SInce it could not be expected, that a Work of this Nature should escape the Press, without many Errata's; especially considering, the Author living at *Dundee*, and the Book printed at *Aberdeen*; being a considerable distance. Therefore thy Candour and Love is here intreated, to amend these which are set down unto thy view, and to help any other small escapes thy self, which may appear unto thee in perusing the Book. This being humbly desired by the *Author* and the *Printer*.

Pag. 15. *Lin.* 15. *for,* Complement the Latitude? *Read,* Complement of the Latitude ?

Pag. 71. *Lin.* 18. 20. 23. 24. 25. *for,* Signe and Sign *Read,* Sines and Sine

Pag. 78. *Lin.* 8. *for,* riseth, *Read,* resteth,

Pag. 103. *the last Line, after* Limet and Ort, *add,* North-West, *which is ommitted in the print.*

Pag. 167. *Lin.* 7. *for,* to attain the Latitude thereof over all the Earth, *Read,* to attain the Latitude over all the Earth, *and cancel the word* Glo-